SOIL SURVEY OF

Todd County, South Dakota

U.S. Department of Agriculture
Soil Conservation Service and
United States Department of the Interior
Bureau of Indian Affairs
In cooperation with
South Dakota Agricultural Experiment Station

Issued April 1974

Major fieldwork for this soil survey was done in the period 1959–64. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1964. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Todd County Soil and Water Conservation District and the Rosebud Sioux Tribe.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Consevation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Todd County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information.This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site, pasture group, and windbreak group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites, capability units, pasture groups, and windbreak groups.

Foresters and others can refer to the section "Use of the Soils for Windbreaks," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils as Wildlife Habitat."

Ranchers and others can find, under "Use of the Soils as Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Todd County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County" and in information given at the beginning of the publication.

Cover: **Farmstead windbreak on Tuthill silt loam, 0 to 3 percent slopes.**

U.S. GOVERNMENT PRINTING OFFICE: 1973

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Contents

Issued April 1974

SOIL SURVEY OF TODD COUNTY, SOUTH DAKOTA

BY ROBERT F. SPRINGER, SOIL CONSERVATION SERVICE

SURVEYED BY ROBERT F. SPRINGER AND LYLE PASCHKE, SOIL CONSERVATION SERVICE, AND EDWARD BOOKLESS, REX CAREY, DALE R. GENGENBACH, WARREN JOHNSON, TED KARNS, RICHARD KRUEGER, ROY LEMBKE, JACK SAFFORD, ALBERT THURMAN, AND RUFUS WILLIAMS, BUREAU OF INDIAN AFFAIRS

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, IN COOPERATION WITH THE SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

TODD COUNTY is in the extreme south-central part of South Dakota (fig. 1). It covers an area of 888,320 acres. Mission is the largest town. The county is unorganized and the county administrative offices are in Winner, the county seat of adjacent Tripp County.

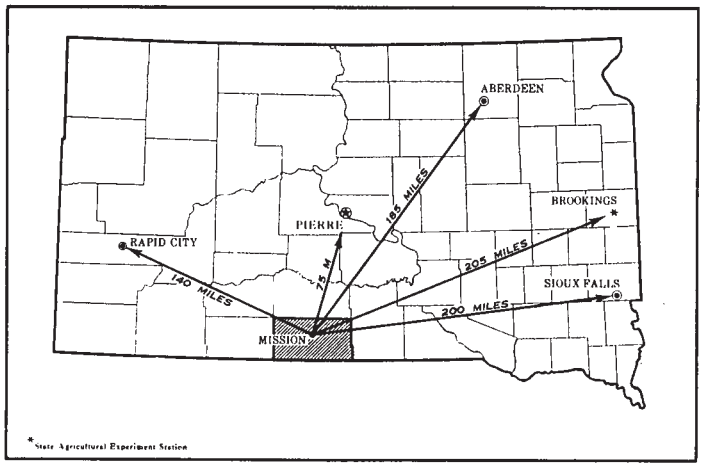


Figure 1.—**Location of Todd County in South Dakota.**

All of Todd County is in the Rosebud Indian Reservation. About 65 percent of the total acreage is tribal land and Indian allotment land administered by the Bureau of Indian Affairs. Much of the Indian land is concentrated in the western part of the county, but scattered tracts are intermingled with non-Indian land throughout the county.

Surface relief ranges from nearly level on tablelands in the central part of the county to steep and rough broken on the sides of buttes and canyons. Elevation above sea level ranges from 2,150 feet in the northeastern part of the county to 3,150 feet in the southwestern part.

Surface drainage systems are well defined except in the Sandhills in the southwestern part of the county. Much of the western part of the county is drained by the Little White River. The extreme northeastern part of the county is drained by creeks flowing northward to the White River, and the extreme southwestern part is drained by the Minnechadusa River. The central and southeastern parts of the county are drained by the Keya Paha River that flows to the southeast.

The climate is subhumid. Summers are hot, and winters are cold. Native grasses made up the original vegetation, but some trees were on bottom lands and on rough, broken areas along the Little White River.

Cattle ranching is the main enterprise. Only about 13 percent of the acreage of the county is used for crops. Alfalfa, oats, corn, and wheat are the main crops. Sorghum and barley also are grown.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Todd County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Tuthill and Valentine, for example, are the names of two soil series. All the soils in the United States having the same series name are essen-

tially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Tuthill silt loam, 0 to 3 percent slopes, is one of several phases within the Tuthill series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Todd County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Valentine-Tassel complex, 5 to 30 percent slopes.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Richfield and Canyon soils, 9 to 21 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gravelly land is a land type in Todd County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Todd County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Todd County are each discussed in the following pages. The terms for texture used in the titles for the associations apply to the surface layer. For example, in the title for association 1, the word "clayey" refers to texture of the surface layer.

Well-Drained Clayey Soils Over Soft Clay Shale; on Uplands

This group includes clayey soils that formed in material weathered from the underlying clay shale or in material transported locally by wind and water. The gently sloping soils commonly are cultivated, but they are subject to both water erosion and soil blowing.

1. Millboro-Boyd association

Deep and moderately deep, nearly level to steep, well-drained clayey soils; on uplands

This association is on uplands in the northeastern part of the county. Much of it is gently sloping to sloping, except on the sides of buttes and drainageways. The gentle slopes are long and smooth, and they have a plane to

convex shape. Drainage patterns are well defined except in the nearly level areas around small depressions.

This association makes up about 2 percent of Todd County. It is about 70 percent Millboro soils, 15 percent Boyd soils, and 15 percent minor soils (fig. 2).

Millboro soils are nearly level to sloping. The slopes are long and smooth. The surface layer is very dark grayish-brown silty clay. The subsoil is dark grayish-brown to light brownish-gray clay that is calcareous in the lower part. Light olive-gray, calcareous clay is below a depth of 32 inches.

Hilly to steep Boyd soils are on convex ridges above Millboro soils and on the sides of buttes and draws. They are moderately deep over soft clay shale and have a surface layer of dark-gray clay. The subsoil is dark grayish-brown to grayish-brown, calcareous clay. The underlying material is grayish-brown clay over weathered soft shale at a depth of 38 inches.

Less extensive soils in this association are in the Hoven and Samsil series. Also in this association are small areas of Loamy alluvial land. Hoven soils are in depressions and along drainageways. Loamy alluvial land is along the larger drainageways on bottom lands. Hilly to steep Samsil soils are on the shoulders of drainageways and the sides of ridges and buttes.

Surface runoff is medium to rapid on the soils of this association, and permeability is slow. Control of water erosion and soil blowing and maintenance of tilth, con-

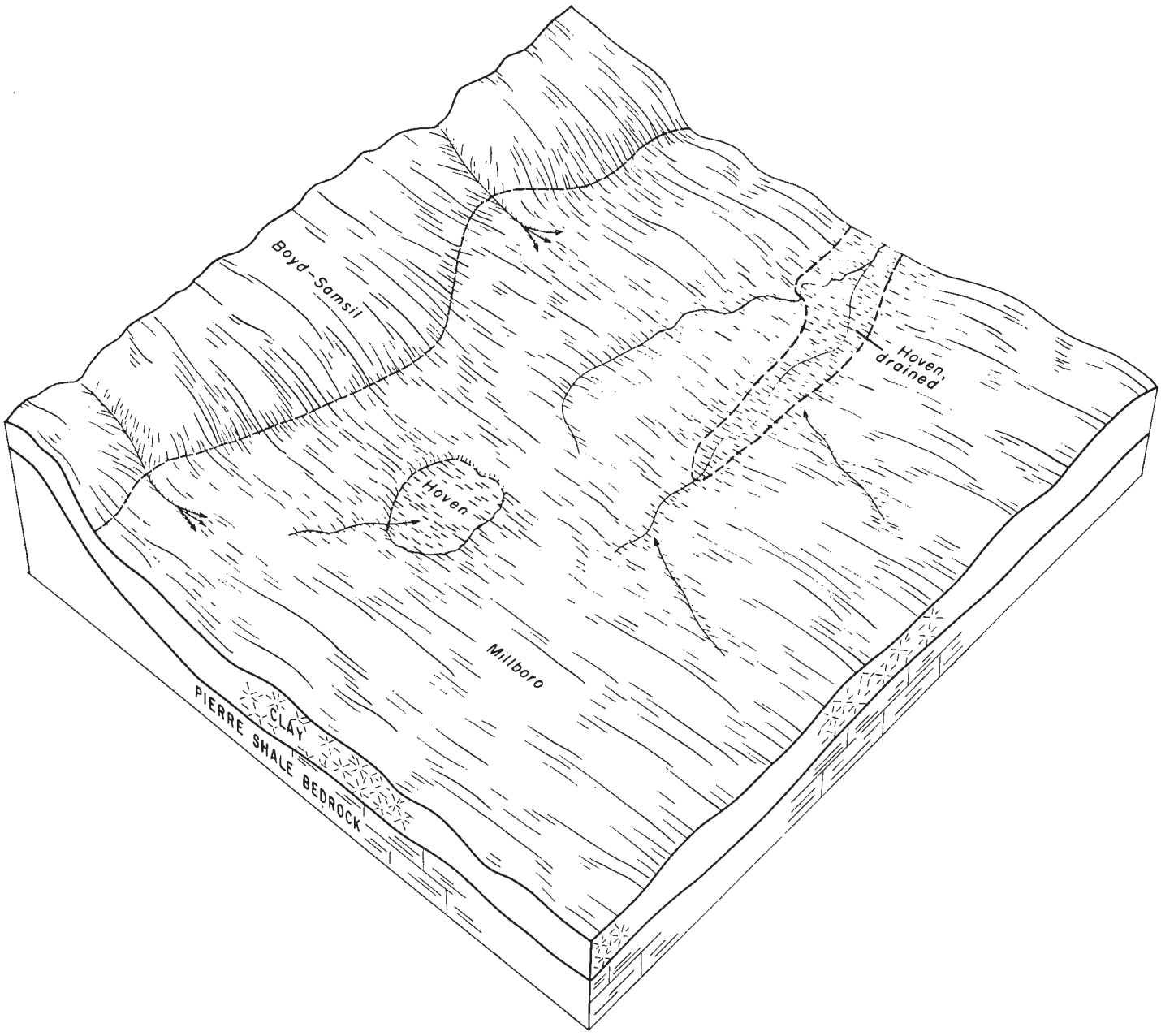


Figure 2.—**Typical pattern of soils in association 1.**

tent of organic matter, and fertility are the main concerns of management.

Most of the cropland of this association is in areas of Millboro soils. Winter wheat, oats, sorghum, alfalfa, and tame grasses are the main crops. Some corn is also grown. Many areas are in native grass and are used for grazing. Ground water is scarce and of poor quality. Water for livestock is provided by surface water impounded in farm ponds and dugouts. Most of the farmsteads and ranch headquarters are within 1 mile of U.S. Highway No. 18.

Well-Drained to Somewhat Excessively Drained Silty and Loamy Soils Over Siltstone; on Uplands

This group consists of silty soils that formed in material weathered from the underlying siltstone or in material transported locally by wind and water. Silty and loamy soils that formed in loamy deposits and that are thinly covered by silty loess are scattered throughout these associations. Most areas of the soils in these associations are used as range, but scattered areas of the more gently sloping soils are cultivated.

2. Kadoka-Tuthill-Huggins association

Moderately deep and deep, nearly level to sloping, well-drained silty and loamy soils; on uplands

Most of this association is in the northern part of the county. The areas commonly are gently sloping to sloping, but a few are undulating. Slopes are convex and are moderately long except in the undulating areas. Drainage systems are well defined.

This association makes up about 22 percent of Todd County. It is about 20 percent Kadoka soils, 20 percent Tuthill soils, 15 percent Huggins soils, and 45 percent minor soils (fig. 3).

Kadoka soils are nearly level to sloping and are moderately deep over soft siltstone. They have a grayish-brown silt loam surface layer and a subsoil of grayish-brown to light yellowish-brown silty clay loam. The underlying material is very pale-brown, calcareous silt loam. Soft siltstone is at a depth of 38 inches.

Tuthill soils are deep and are nearly level to undulating. In this association the surface layer of Tuthill soils commonly is dark grayish-brown silt loam, but it is fine sandy loam in places. The subsoil is clay loam or sandy clay loam. The underlying material ranges from loam to loamy sand.

Huggins soils are nearly level to sloping and are moderately deep over hard siltstone. They have a surface layer of dark-gray silt loam and a grayish-brown subsoil of silty clay loam and silty clay. The underlying material is pinkish-gray clay loam over very pale brown siltstone at a depth of 26 inches.

Less extensive soils in this association are in the Altvan, Epping, Goshen, Hoven, Keith, Keota, Keya, Minatare, Mosher, Okreek, Orella, Richfield, Shena, Wanblee, and Wortman series. Also in this association are small areas of Loamy alluvial land. Altvan soils are on terraces and uplands. The moderately steep to steep Epping, Keota, Okreek, and Orella soils are on the sides of deeply incised drainageways and canyons that cut into the area. Goshen and Keya soils are in swales. Hoven soils are in depressions. Gently sloping Keith and Richfield soils are scattered throughout the uplands. Loamy alluvial land is on bottom lands. Minatare and Mosher soils are on stream terraces. Shena soils are near areas of Huggins soils. Wanblee and Wortman soils are on upland flats and along upland drainageways.

Surface runoff is slow to medium on most of the soils in this association. Available water capacity is moderate in all the soils except Huggins soils. Huggins soils have low available water capacity, and they are droughty. Control of erosion and conservation of moisture are the main concerns of management.

Alfalfa, winter wheat, sorghum, and corn are the main crops grown on scattered areas of cropland. Much of this association is in native grass and is used for grazing. Water for livestock is provided by wells and by surface water impounded in ponds and dugouts. Population is sparse except in the vicinity of Mission and Parmalee. Roads and trails are on about half of the section lines and feed into U.S. Highway No. 18. Nearly all areas are accessible by vehicle.

3. Epping-Keota-Kadoka association

Shallow and moderately deep, sloping to steep, well-drained to somewhat excessively drained silty soils; on uplands

This association is on uplands on both sides of the Little White River. It extends from the vicinity of Ghost Hawk Park north to the county line. It consists of soils on narrow ridges and of sloping to steep soils on the sides of draws and canyons that drain to the river.

This association makes up about 7 percent of Todd County. It is about 30 percent Epping soils, 30 percent Keota soils, 15 percent Kadoka soils, and 25 percent minor soils.

Epping soils are on ridges and on the steep sides of draws and canyons. They are well drained to somewhat excessively drained. Their profile is shallow and consists of pale-brown, calcareous silt loam over white to very pale brown siltstone.

Keota soils are well drained and are closely intermingled with Epping soils. Their surface layer is light brownish-gray calcareous silt loam. Below this layer is pale-brown and light-gray silt loam and white siltstone at a depth of 31 inches.

Kadoka soils are sloping to strongly sloping. They have a grayish-brown silt loam surface layer and a subsoil of grayish-brown to light yellowish-brown silty clay loam. Below the subsoil is very pale brown, calcareous silt loam over soft siltstone which is at a depth of 38 inches.

Less extensive soils in this association are in the Dunday, Huggins, Richfield, Shena, Tuthill, Wanblee, and Wortman series. Also in this association are small areas of Loamy alluvial land and Rock outcrop. Dunday soils are on stream terraces. Huggins, Richfield, Shena, and Tuthill soils are the more gently sloping soils of the association. Wanblee and Wortman soils are on flats and along drainageways on uplands. Loamy alluvial land is on the narrow bottom lands of canyons and draws. Rock outcrop is very steep, has many ledges, and is on deeply incised canyons and draws.

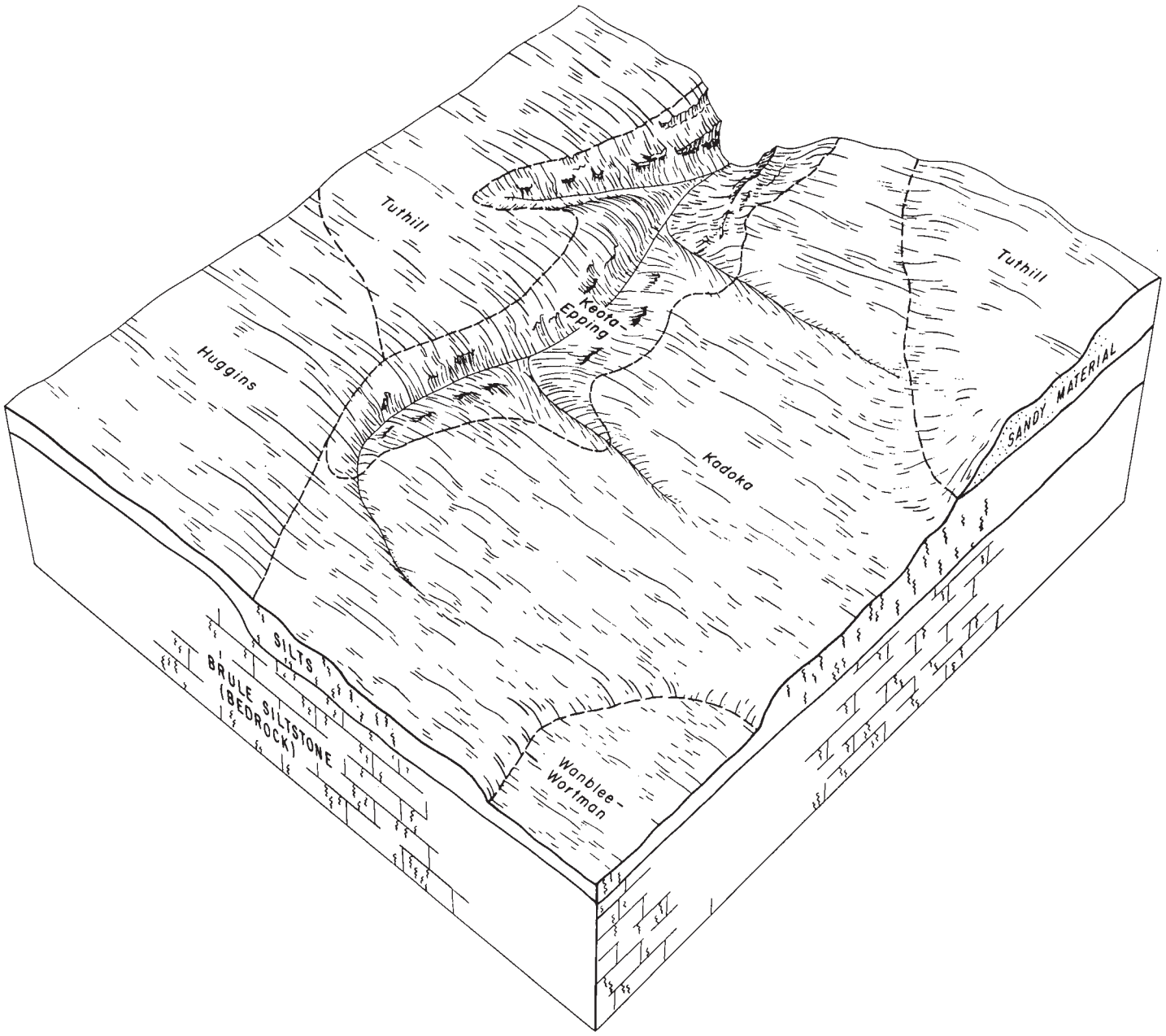


Figure 3.—**Typical pattern of soils in association 2.**

Surface runoff is medium to rapid on the soils of this association. Many of the soils are too steep for cultivation. Epping and Keota soils are low in fertility. Control of erosion is the main concern of management.

Scattered areas of the more gently sloping Kadoka soils and some of the less extensive soils are used as cropland. Alfalfa and small grains are the main crops. Most of the association is in native grass and is used for grazing. Thin stands of ponderosa pine and bur oak grow in places. Shallow wells provide water for livestock in some parts of the association, but the supply is limited. Care is needed in selecting sites for impounding water in ponds because of the likelihood of seepage. Population is sparse, except for Indian settlements near Soldier Creek and Ring Thunder. One main highway crosses the southern part of the association, and most areas can be reached by winding roads and trails. A few are accessible only on horseback.

Well-Drained and Somewhat Excessively Drained Loamy and Sandy Soils Over Sandstone; on Uplands

This group consists of loamy and sandy soils that formed in material weathered from underlying sandstone or in material transported locally by wind and water. Soil texture is mostly fine sandy loam and sandy loam, but in places the texture is loamy fine sand or loamy sand. Many

areas of the more gently sloping soils are cultivated, but soil blowing is a severe hazard.

4. Holt-Anselmo-Vetal association

Moderately deep and deep, nearly level to undulating, well-drained loamy soils; on uplands

This association is a nearly level to undulating tableland underlain by weakly cemented to strongly cemented, calcareous sandstone. A layer of gravel overlies the sandstone on some high ridges. In places as much as several feet of wind-deposited sand overlies the sandstone. Heads of drainageways cut into this association, and the drainage pattern is well defined except in the more sandy parts.

This association makes up about 15 percent of Todd County. It is about 30 percent Holt soils, 20 percent Anselmo soils, 15 percent Vetal soils, and 35 percent minor soils (fig. 4).

Holt soils are moderately deep and have a surface layer of dark grayish-brown sandy loam. The subsoil is dark grayish-brown to grayish-brown sandy loam that is light gray in the lower part. White sandstone is at a depth of 22 inches.

Anselmo soils are on foot slopes and on higher lying slopes where the soil material is 4 feet or more thick over sandstone. These soils have a surface layer of dark-gray to dark grayish-brown fine sandy loam. The subsoil is grayish-brown sandy loam in the upper part and light

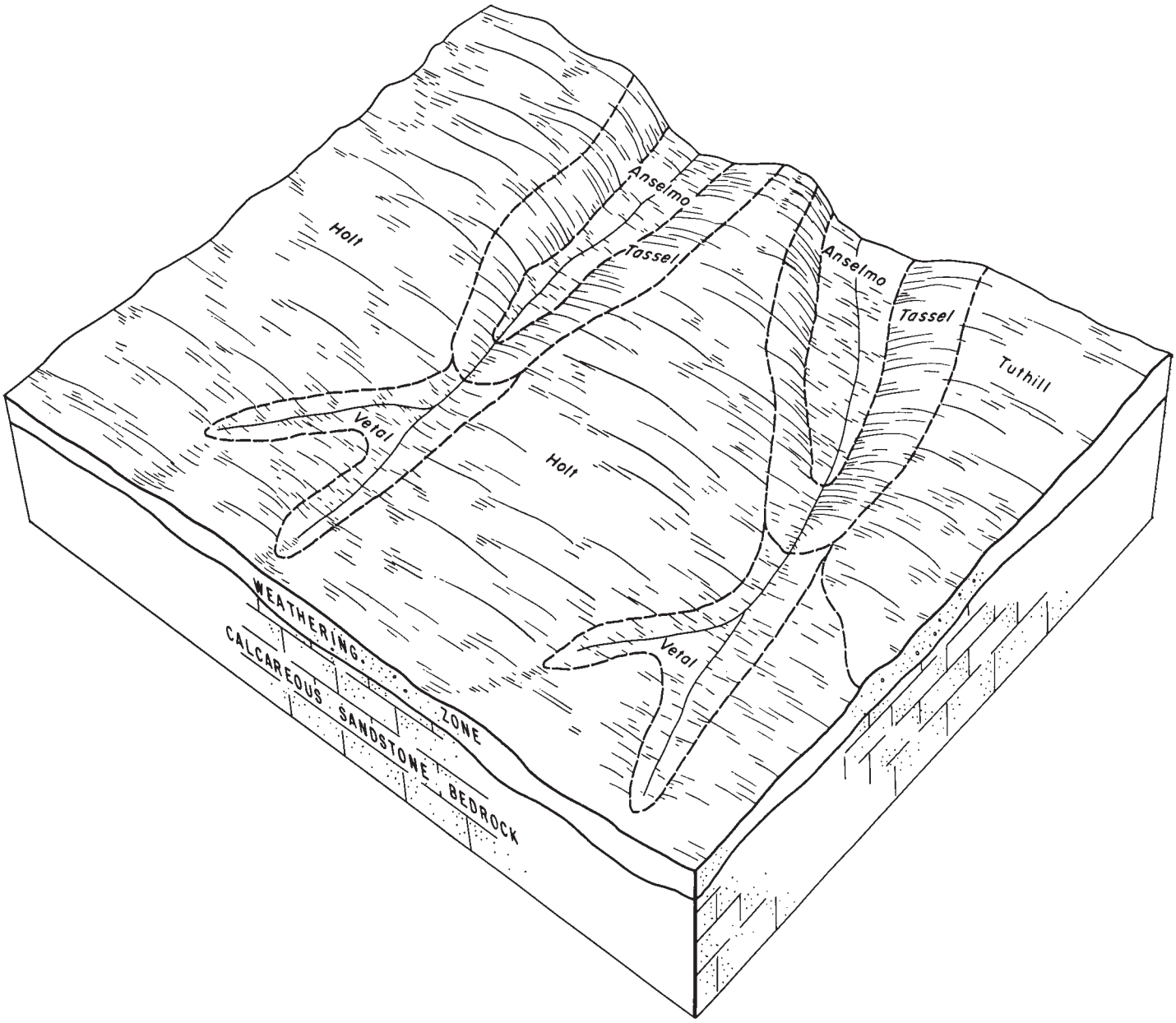


Figure 4.—Typical pattern of soils in association 4.

olive-brown loamy fine sand in the lower part. The underlying material is light olive-brown loamy sand.

Vetal soils are in swales. These soils have a thick surface layer of dark-gray fine sandy loam. Below this layer is a thick layer of dark grayish-brown sandy loam. The underlying material is grayish-brown sandy loam in the upper part and pale-brown loamy sand below a depth of 44 inches.

Less extensive soils in this association are in the Altvan, Chappell, Dix, Doger, Duda, Dunday, Elsmere, Keya, Richfield, Tassel, Tuthill, Valentine, and Wann series. Altvan and Chappell soils are on uplands and terraces and are underlain by gravel. Dix soils are on gravelly ridges and terrace fronts. Doger, Dunday, and Valentine soils are on undulating to rolling sandy areas. Duda and Tassel soils are on ridges. Elsmere and Wann soils are on bottom lands and in low areas. These soils have a high water table. Keya soils are in some swales on uplands. The slopes of Richfield and Tuthill soils are smooth and long.

Soils of this association are moderate to high in organic-matter content. Fertility is medium to low in the Holt soils and medium to high in the other soils. Soil blowing is a hazard on all of these soils, and erosion is a hazard on the sloping soils. The main concern of management is control of soil blowing.

About 35 percent of this association is cultivated, and about 40 percent of the cropland of the county is in this association. Spring-sown small grains, alfalfa, and corn are the main crops. Grain and forage sorghums are also grown. Holt soils are droughty and are less suited to corn than the other soils. Ranching is the main enterprise, and most crops are fed to the livestock. Shallow wells provide water for livestock and for domestic uses. The rapid permeability of the underlying sandy material generally makes ponds and dugouts impractical. This association is one of the more populated areas of the county. Roads and trails are on most of the section lines.

5. *Anselmo-Ronson-Vetal association*

Deep and moderately deep, nearly level to rolling, well-drained loamy soils; on uplands

This association is on uplands in the southeastern part of the county. Most areas are gently undulating to rolling and are underlain by weakly cemented to strongly cemented calcareous sandstone. Slopes commonly are short and irregular. In places drainage systems are poorly defined.

This association makes up about 11 percent of Todd County. It is about 30 percent Anselmo soils, 25 percent Ronson soils, and 15 percent Vetal soils. Minor soils make up the remaining 30 percent.

Anselmo soils are on the sides and tops of the more gentle undulations. Their surface layer is dark-gray to dark grayish-brown fine sandy loam, and the subsoil is grayish-brown sandy loam over loamy sand.

Ronson soils commonly are on the upper parts of convex ridges and knolls. They are calcareous and are moderately deep over sandstone. The surface layer is dark-gray to grayish-brown fine sandy loam over very pale brown sandy loam. Very pale brown sandstone is at a depth of 35 inches.

465-344—74——2

Vetal soils are in swales. They have a thick surface layer of dark-gray fine sandy loam over a thick layer of dark grayish-brown sandy loam to a depth of 35 inches. Below this is grayish-brown sandy loam and pale-brown loamy sand.

Less extensive soils in this association include soils of the Chappell, Doger, Duda, Dunday, Elsmere, Tassel, Valentine, and Whitelake series. Also in this association are small areas of Saline lowland. Chappell soils are on terraces. Doger, Duda, Dunday, and Valentine soils are on rolling sandy parts of the association; Elsmere and Whitelake soils and Saline lowland are on bottom lands. Tassel soils are on high ridges and hilltops.

Available water capacity is moderate to low in the soils of this association. Ronson soils are calcareous and are moderate to moderately low in content of organic matter and are low in fertility. Soil blowing is a hazard. Control of soil blowing is the main concern of management.

Alfalfa and spring-sown small grains are the main crops on scattered tracts of cropland. Ronson soils are better suited to these crops than to row crops. Most of the association is in native grass and is used for grazing. Rapid permeability in the underlying sand and sandstone makes the soils unsuited to impoundment of surface water for livestock. Water is obtained easily from shallow wells. The population is sparse. Most of the farmsteads and ranch headquarters are in the western part of the association. A few roads and trails in this part feed into the main north-to-south highway. Only a few winding ranch trails serve the eastern part of the association.

6. *Anselmo-Tassel-Dunday association*

Deep and shallow, gently undulating to steep, well-drained and somewhat excessively drained loamy and sandy soils; on uplands

This association consists of a hilly to steep escarpment with deeply incised drainages extending from the high tablelands in the south-central part of the county to lower landforms along the Keya Paha and Little White Rivers. Gently undulating to rolling soils are along drainage heads, on drainage divides between the canyons and draws, and below the steep ridges.

This association makes up about 28 percent of Todd County. It is about 30 percent Anselmo soils, 20 percent Tassel soils, 15 percent Dunday soils, and 35 percent minor soils.

Anselmo soils are on the side slopes in gently undulating to hilly areas. Their surface layer is dark-gray to dark grayish-brown fine sandy loam, and the subsoil is grayish-brown sandy loam over loamy sand.

Tassel soils are shallow and are on steep ridges, peaks, and the upper parts of the side slopes of canyons and draws. They have a thin surface layer of gray fine sandy loam over light brownish-gray sandy loam. White loamy fine sand and sandstone are at a depth of 10 inches.

Dunday soils are on side slopes in the more sandy, gently undulating to rolling areas below the Tassel soils. They have a surface layer of dark grayish-brown loamy fine sand over loamy fine sand and fine sand.

Less extensive soils in this association are soils of the Canyon, Chappell, Dawes, Doger, Duda, Elsmere, Keith, Richfield, Ronson, Tuthill, Valentine, and Whitelake

series. Also in this association are small areas of Rock outcrop. The Canyon, Duda, and Ronson soils are on the higher lying slopes of ridges and peaks. Chappell soils are in areas underlain by gravel. Dawes, Keith, Richfield, and Tuthill soils are on divides on uplands. Slopes are smooth. Doger and Valentine soils are in the more sandy parts of the association. Elsmere and Whitelake soils are on bottom lands and low terraces. Small areas of Rock outcrop are on the higher lying slopes of peaks, ridges, and canyons.

Tassel soils are too shallow for cultivation. They are low in fertility and content of organic matter. The soils in much of this association are too steep and too irregular in slope for cultivation. Soil blowing is a severe hazard. The main concern of management is control of soil blowing.

Most of the association is in native grass and is used for grazing. Alfalfa and spring-sown small grains are the main crops on scattered areas of cropland. Some corn, winter wheat, and sorghums are also grown. The crops are grown mainly on Anselmo soils and on the less extensive soils. Rapid permeability in the underlying sand and sandstone makes the soils unsuited to impoundments of surface water in ponds. Wells, springs, and ground-water dugouts provide water of good quality for livestock. The population is sparse, except in the village of Rosebud. Most of the section lines do not have roads or trails, but several roads and trails serve the area. Parts of the association can be reached only by following winding trails or by traveling cross country.

7. *Rough broken land-Doger association*

Deep, nearly level to very steep, well-drained and somewhat excessively drained mixed sandy soils; on uplands

This association consists mainly of steep to very steep river breaks on both sides of the Little White River extending from the vicinity of the community of Spring Creek north to Ghost Hawk Park. Slopes are as much as 70 percent on the sides of deeply incised V-shaped canyons and draws. The difference in elevation from the river to the high tableland several miles to the southeast is about 450 feet.

This association makes up about 4 percent of Todd County. It is about 40 percent Rough broken land, 25 percent Doger soils, and 35 percent minor soils.

Rough broken land consists of steep to very steep, mixed sandy soils. Most of these soils are deep, but some are shallow to sandstone. They commonly have a dark-colored surface layer of loamy sand over fine sand that is calcareous at varying depths.

Doger soils are nearly level to gently undulating and are on foot slopes and valley floors. They have a surface layer of very dark grayish-brown loamy fine sand over dark grayish-brown loamy fine sand. Pale-brown fine sand is below a depth of 32 inches.

Less extensive soils in this association are soils of the Dunday, Elsmere, Epping, Tassel, and Valentine series. Also in this association are small areas of Sandy alluvial land. Dunday soils are on low terraces. Elsmere soils and Sandy alluvial land are on bottom lands. Epping and Tassel soils are on the upper part of steep slopes and on ridges and peaks. Valentine soils are on rolling to hilly foot slopes.

This association is not suited to cultivation because of the rough, broken topography and the hazard of soil blowing if a vegetative cover is not kept on the areas. Only a few small tracts of Doger soils and less extensive soils are cultivated.

Most of the association is in native vegetation, which consists of tall and mid grasses interspersed with thin to moderately dense stands of ponderosa pine. In places the pine grows to merchantable size. Bur oak, cottonwood, ash, boxelder, and chokecherry are among the native trees and shrubs that grow on low terraces and bottom lands in the valleys. Springs and small flowing streams provide water for wildlife and livestock. This association, a part of the Rosebud Indian Reservation Timber Reserve, is being developed as a wildlife and recreational area. An improved road along the Little White River extends through the area, but otherwise much of the association is inaccessible by vehicle.

Excessively Drained and Somewhat Excessively Drained Sandy Soils Formed in Eolian Sands; on Uplands

This group consists of sandy soils that formed in eolian sands. These soils are an extension of the Nebraska Sandhills. Nearly all areas are used as rangeland. These soils are too sandy for cultivation, and soil blowing is a severe hazard.

8. *Valentine-Dunday association*

Deep, gently undulating to steep, excessively drained and somewhat excessively drained sandy soils; on uplands

This association is in the Sandhills part of Todd County. Most areas are undulating to hilly. Slopes are short and well rounded on the ridges and knolls that rise 20 to 75 feet above the low spots. Drainage systems are poorly defined.

This association makes up about 9 percent of Todd County. It is about 75 percent Valentine soils, 15 percent Dunday soils, and 10 percent minor soils (fig. 5).

Valentine soils are on the higher lying slopes and are excessively drained. They have a thin, dark grayish-brown surface layer of fine sand over brown and light-gray fine sand.

The somewhat excessively drained Dunday soils are in the lower, concave areas and on the sides of the more gently undulating areas. They have a dark grayish-brown surface layer of loamy fine sand over grayish-brown loamy fine sand. The underlying material below a depth of 22 inches is pale-brown fine sand.

Less extensive soils in this association are in the Doger, Elsmere, Loup, Tassel, and Whitelake series. Doger soils are on foot slopes and in swales and dry valleys. Elsmere and Loup soils are on bottom lands and in depressed areas. Tassel soils are on the peaks of some of the steep ridges. Whitelake soils are in areas that adjoin some of the bottom lands.

Soil blowing is a hazard on the soils of this association. Blowouts form easily along roads and trails and around water facilities frequented by livestock. Control of soil blowing is the main concern of management.

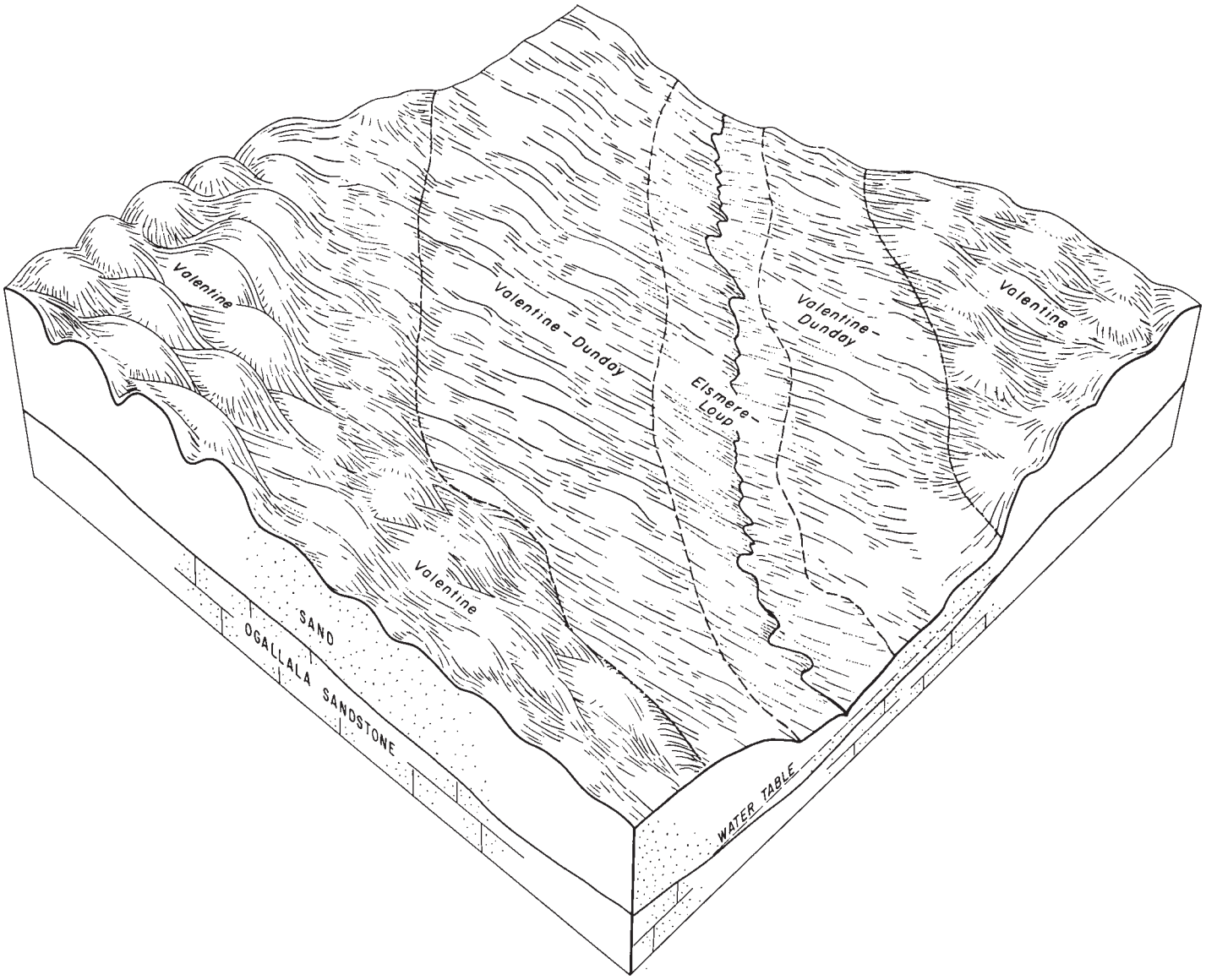


***Figure 5.*—Typical pattern of soils in associations 8 and 10. Areas of association 10 are commonly within areas of association 8.**

Nearly all of the association is in native grass and is used for grazing. Alfalfa is the main crop in the few cultivated tracts in areas of the less extensive soils. Shallow wells provide abundant supplies of water for livestock. The soils are too sandy for impounding water. The population is sparse. The ranches are large. Access is provided by winding roads and trails leading to ranch headquarters.

Somewhat Poorly Drained to Very Poorly Drained Sandy and Loamy Soils Formed in Alluvium; in Stream Valleys

This group consists of sandy and loamy soils that formed in sandy alluvium. The high water table of these soils is a moderate to severe limitation to use for crops. Many areas are used for hay.

9. Elsmere-Wann association

Deep, nearly level, somewhat poorly drained sandy and loamy soils; on bottom lands and low terraces

This association is on bottom lands and low terraces along Antelope Creek and the Keya Paha River. Flood channels and slight undulations break the nearly level relief.

This association makes up less than 1 percent of Todd County. It is about 55 percent Elsmere soils, 40 percent Wann soils, and 5 percent minor soils.

Elsmere soils have a thick surface layer of dark grayish-brown to very dark grayish-brown loamy fine sand over light brownish-gray loamy fine sand. The underlying material is gray, calcareous loamy fine sand and sandy loam.

Wann soils are on bottom lands and low terraces at slightly higher levels than Elsmere soils. They have a

dark-gray to dark grayish-brown surface layer of sandy loam and fine sandy loam. Below this layer is grayish-brown to light brownish-gray fine sandy loam and sandy loam to a depth of 54 inches.

Less extensive soils in this association are in the Chappell and the Mosher series. Chappell soils are on terraces. Mosher soils are in areas scattered throughout the association.

Surface runoff is slow on the soils of this association. These soils are subject to flooding. During years of heavy precipitation planting is delayed because of the high water table. Improving drainage and controlling soil blowing are the main concerns of management.

Nearly all areas are used for tame and native grasses for hay. Alfalfa and small grains are the main crops in cultivated areas.

10. Elsmere-Loup association

Deep, nearly level, somewhat poorly drained to very poorly drained sandy soils; on bottom lands

This association is on bottom lands along the Minnechadusa River and Spring Creek. It is surrounded by soils of association 8. (See figure 5.)

This association makes up about 1 percent of Todd County. It is about 50 percent Elsmere soils, 30 percent Loup soils, and 20 percent minor soils.

Elsmere soils have a surface layer of dark grayish-brown to very dark grayish-brown loamy fine sand. Below this layer is loamy fine sand and sandy loam.

Loup soils are at slightly lower levels than Elsmere soils, and they have a water table that is near the surface early in the growing season. Their surface layer is very dark gray to dark-gray loamy fine sand and sandy loam. Below the surface layer is gray loamy sand that becomes light-gray fine sand at a depth of 15 inches.

Less extensive soils in this association are in the Doger, Dunday, and Gannett series. Doger and Dunday soils are on some of the higher undulations at the outer parts of the association. Gannett soils are in the lowest parts of the association.

Surface runoff is slow or very slow on the soils in this association. The water table is near the surface of the soils in the lower parts of the association during the early part of the growing season. Soil blowing is a severe hazard. Controlling soil blowing and improving drainage are concerns of management.

Many areas are in native grass and are used for hay. Alfalfa is the main crop grown in scattered areas. Loup soils generally are too wet for cultivation. Shallow wells, springs, and small streams are sources of water for livestock.

Descriptions of the Soils

This section describes the soil series and mapping units in Todd County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gravelly land, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the range site, capability unit, pasture group, and windbreak group in which the mapping unit has been placed. The page for the description of each range site, capability unit, windbreak group, or other interpretative group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*12*).[1]

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Such differences in name result from changes in the concepts of soil classifications that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Altvan Series

The Altvan series consists of nearly level to gently sloping, loamy soils that are moderately deep over sand and gravel. These soils formed in alluvium and are on uplands and terraces.

In a representative profile the surface layer is grayish-brown loam about 4 inches thick. The subsoil is about 17 inches thick. It is dark grayish-brown sandy loam and sandy clay loam in the upper part and brown sandy loam in the lower part. It is hard or very hard when dry and friable or firm when moist. The underlying material is light-gray, calcareous loamy sand and fine gravel that grades to very pale brown, calcareous gravel and sand.

Altvan soils are well drained. Surface runoff is slow to medium. Permeability is moderate in the surface layer and in the subsoil, but it is rapid in the underlying material. Available water capacity is low to moderate. Fertility is medium, and content of organic matter is moderate.

[1] Italic numbers in parentheses refer to Literature Cited, p. 88.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Altvan loam, 0 to 2 percent slopes	1, 630	0. 2	Millboro silty clay, 5 to 9 percent slopes	5, 720	0. 6
Altvan loam, 2 to 5 percent slopes	330	(1)	Mosher silt loam, 0 to 4 percent slopes	6, 640	. 8
Anselmo fine sandy loam, 2 to 5 percent slopes	37, 900	4. 3	Mosher-Minatare silt loams, 0 to 4 percent slopes	4, 600	. 5
Anselmo fine sandy loam, 5 to 9 percent slopes	20, 900	2. 4	Okreek silty clay, 5 to 9 percent slopes	3, 120	. 4
Anselmo-Ronson fine sandy loams, 5 to 9 percent slopes	6, 050	. 7	Okreek-Orella complex, 6 to 21 percent slopes	4, 260	. 5
Anselmo-Tassel fine sandy loams, 9 to 21 percent slopes	80, 900	9. 1	Orella-Rock outcrop complex, 15 to 40 percent slopes	1, 950	. 2
Anselmo-Tuthill fine sandy loams, 9 to 21 percent slopes	3, 140	. 4	Peaty muck	440	(1)
Anselmo-Vetal fine sandy loams, 0 to 2 percent slopes	21, 600	2. 4	Richfield and Canyon soils, 9 to 21 percent slopes	4, 010	. 5
Boyd-Samsil clays, 6 to 19 percent slopes	2, 100	. 2	Richfield-Dawes silt loams, 0 to 2 percent slopes	6, 340	. 7
Chappell-Anselmo fine sandy loams, 0 to 3 percent slopes	4, 940	. 6	Richfield-Tuthill silt loams, 2 to 9 percent slopes	12, 700	1. 4
Chappell-Anselmo fine sandy loams, 3 to 5 percent slopes	1, 450	. 2	Ronson-Anselmo fine sandy loams, 0 to 3 percent slopes	4, 300	. 5
Dix-Chappell fine sandy loams, 3 to 9 percent slopes	3, 040	. 3	Ronson-Anselmo fine sandy loams, 3 to 5 percent slopes	10, 830	1. 2
Doger loamy fine sand, 0 to 3 percent slopes	7, 400	. 8	Rough broken land	25, 800	2. 9
Doger-Dunday loamy fine sands, 3 to 6 percent slopes	9, 240	1. 0	Saline lowland	740	. 1
Duda loamy fine sand, 0 to 6 percent slopes	6, 990	. 8	Samsil-Boyd clays, 19 to 30 percent slopes	850	. 1
Dunday fine sandy loam, 0 to 2 percent slopes	1, 200	. 1	Sandy alluvial land	4, 800	. 5
Dunday loamy fine sand, 0 to 2 percent slopes	3, 330	. 4	Shena silt loam, 0 to 9 percent slopes	9, 600	1. 1
Elsmere loamy fine sand, 0 to 3 percent slopes	14, 200	1. 6	Tassel-Rock outcrop complex, 25 to 40 percent slopes	13, 000	1. 5
Gannett sandy loam	1, 350	. 2	Tassel-Ronson fine sandy loams, 3 to 30 percent slopes	33, 100	3. 7
Goshen silt loam	1, 690	. 2	Tuthill silt loam, 0 to 3 percent slopes	13, 700	1. 5
Gravelly land	1, 030	. 1	Tuthill silt loam, 3 to 5 percent slopes	7, 900	
Holt fine sandy loam, 0 to 3 percent slopes	15, 100	1. 7	Tuthill silt loam, 5 to 9 percent slopes	5, 085	. 9
Holt-Vetal fine sandy loams, 3 to 9 percent slopes	56, 500	6. 3	Tuthill-Anselmo fine sandy loams, 3 to 9 percent slopes	18, 500	. 6 2. 1
Hoven silt loam, 0 to 1 percent slopes	850	. 1	Tuthill-Tassel fine sandy loams, 3 to 9 percent slopes	3, 470	. 4
Hoven silt loam, drained, 0 to 5 percent slopes	2, 010	. 2	Tuthill-Vetal fine sandy loams, 0 to 3 percent slopes	2, 430	. 3
Huggins silt loam, 0 to 2 percent slopes	10, 100	1. 1	Tuthill-Wortman fine sandy loams, 0 to 3 percent slopes	2, 440	. 3
Huggins-Kadoka silt loams, 2 to 9 percent slopes	11, 300	1. 3	Valentine fine sand, 5 to 30 percent slopes	78, 000	8. 8
Kadoka silt loam, 0 to 2 percent slopes	5, 170	. 6	Valentine-Dunday complex, 3 to 9 percent slopes	65, 400	7. 4
Kadoka-Epping silt loams, 5 to 9 percent slopes	19, 800	2. 2	Valentine-Tassel complex, 5 to 30 percent slopes	19, 400	2. 2
Kadoka-Huggins silt loams, 2 to 5 percent slopes	12, 000	1. 4	Vetal fine sandy loam	7, 500	. 9
Kadoka-Huggins silt loams, 5 to 9 percent slopes	8, 390	. 9	Wanblee-Wortman silt loams, 0 to 6 percent slopes	5, 900	. 7
Keith silt loam, 0 to 2 percent slopes	2, 220	. 3	Wann sandy loam	350	(1)
Keith silt loam, 2 to 9 percent slopes	1, 800	. 2	Wann loam, depressional	2, 730	. 3
Keith-Epping silt loams, 9 to 15 percent slopes	4, 770	. 5	Whitelake fine sandy loam, 0 to 3 percent slopes	4, 600	. 5
Keota-Epping silt loams, 9 to 21 percent slopes	32, 800	3. 7	Wortman fine sandy loam, 0 to 3 percent slopes	1, 950	. 2
Keota-Kadoka silt loams, 9 to 15 percent slopes	14, 190	1. 6	Wortman silt loam, 0 to 6 percent slopes	7, 200	. 8
Keota-Rock outcrop complex, 16 to 40 percent slopes	15, 700	1. 8	Gravel pits	65	(1)
Keya silt loam	10, 060	1. 1	Water, less than 40 acres	3, 500	. 4
Loamy alluvial land	5, 620	. 6	Water, more than 40 acres	320	(1)
Loup-Elsmere loamy fine sands	19, 700	2. 2			
Millboro silty clay, 0 to 2 percent slopes	2, 180	. 2	Total	888, 320	100. 0
Millboro silty clay, 2 to 5 percent slopes	4, 410	. 5			

[1] Less than 0.05 percent.

Most areas are in native grass and are used for grazing. Small grains, alfalfa, and tame grasses are the main crops.

Representative profile of Altvan loam, 0 to 2 percent slopes, in area formerly cultivated; 2,565 feet north and 150 feet east of the SW. corner of sec. 6, T. 39 N., R. 31 W.:

Ap—0 to 4 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and thick, platy structure that parts to moderate, medium, granular; soft, very friable; mildly alkaline; abrupt, smooth boundary.

B1—4 to 8 inches, dark grayish-brown (10YR 4/2) heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, friable; neutral; clear, smooth boundary.

B2t—8 to 15 inches, dark grayish-brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm; neutral; clear, smooth boundary.

B3—15 to 21 inches, brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; very hard, friable; moderately alkaline; abrupt, smooth boundary.

IIC1ca—21 to 32 inches, light-gray (10YR 7/2) loamy sand and fine gravel, brown (10YR 5/3) when moist; single grain; slightly hard, friable; gravel makes up about 10 percent of horizon, by volume; calcareous; moderately alkaline; gradual boundary.

IIC2ca—32 to 50 inches, very pale brown (10YR 8/3) fine gravel and fine sand; single grain; loose; gravel makes up 20 percent of horizon, by volume, and consists of rounded, soft siltstone fragments and hard quartzitic pebbles; calcareous; moderately alkaline.

The A horizon ranges from grayish brown to very dark grayish brown and is 3 to 6 inches thick. The B2t horizon ranges from heavy sandy loam to clay loam. Depth to gravel ranges from 20 to 40 inches. Pebbles generally are scattered throughout the profile.

Altvan soils are near the Chappell, Mosher, and Tuthill soils. They contain more clay and less sand than Chappell soils, and their B horizon is less clayey than that in Mosher soils. Altvan soils have thinner A and B horizons than the Tuthill soils, and, unlike Tuthill soils, they are underlain by gravel at a moderate depth.

Altvan loam, 0 to 2 percent slopes (AlA).—This soil is in areas that are irregular in shape on terraces and along streams. This soil has the profile described as representative for the series. Depth to gravel commonly ranges from 20 to 30 inches.

Included with this soil in mapping are areas of Keya soils in swales. These inclusions are less than 10 percent of any mapped area of this soil. Also included are small areas of slight rises and terrace fronts, where slopes are more than 2 percent.

Surface runoff is slow on this soil. Available water capacity is low, and the soil is droughty.

About half of the acreage of this soil is cultivated. Spring-sown small grains and alfalfa are the main crops. This soil is better suited to these crops than to row crops. The main concerns of management are conserving moisture, controlling soil blowing, and maintaining fertility and content of organic matter. Silty range site; capability unit IIIs-2; pasture group D; windbreak group 6.

Altvan loam, 2 to 5 percent slopes (AlB).—This soil is on terraces along streams. The areas are long and narrow. The surface layer is slightly thinner than that in the profile described as representative for the series. Also, in places depth to gravel is less than 20 inches. Pebbles are scattered over the surface of some ridges. Surface runoff is medium, and the soil is droughty.

Included with this soil in mapping are areas of Keya soils in swales. These inclusions generally are less than 5 percent of any mapped area of this soil. Also included are small areas where slopes are less than 2 percent.

Most of this soil is in native grass and is used for grazing. Small grains are the main crops in cultivated areas, and they are better suited than row crops. Control of water erosion and conservation of moisture are the main concerns of management. Control of soil blowing and maintenance of fertility and the content of organic matter are also concerns of management. Silty range site; capability unit IIIe-6; pasture group D; windbreak group 6.

Anselmo Series

The Anselmo series consists of deep, nearly level to moderately steep, loamy soils on uplands. These soils formed in wind-deposited sandy material.

In a representative profile (fig. 6), the surface layer is dark-gray and dark grayish-brown fine sandy loam about

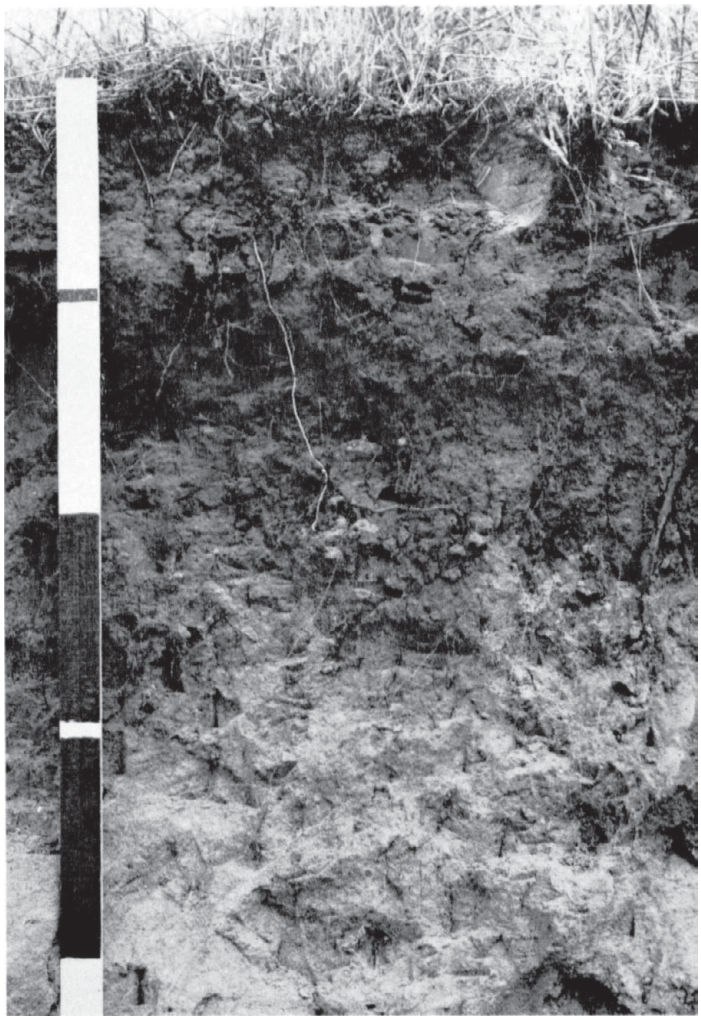


Figure 6.—**Profile of Anselmo fine sandy loam, 2 to 5 percent slopes (AnB). Marker is in increments of 6 inches.**

14 inches thick. The subsoil is about 12 inches thick. It is grayish-brown sandy loam in the upper part and light olive-brown loamy fine sand in the lower part. It is slightly hard when dry and friable to very friable when moist. The underlying material is light olive-brown loamy sand to a depth of 60 inches.

Anselmo soils are well drained. Surface runoff is slow to medium, and permeability is moderately rapid. Available water capacity is moderate to low. Fertility is medium, and content of organic matter is moderate.

Most areas are in native grass and are used for grazing. Oats, alfalfa, and corn are the main crops in cultivated areas.

Representative profile of Anselmo fine sandy loam, 2 to 5 percent slopes, in native grass; 1,320 feet south and 150 feet east of the NW. corner of sec. 19, T. 36 N., R. 31 W.:

A11—0 to 7 inches, dark-gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable; neutral; clear, smooth boundary.

A12—7 to 14 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable; neutral; clear, wavy boundary.

B2—14 to 22 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; slightly hard, friable; neutral; gradual, wavy boundary.

B3—22 to 26 inches, light olive-brown (2.5Y 5/4) loamy fine sand, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, very friable; neutral; abrupt, wavy boundary.

C—26 to 60 inches, light olive-brown (2.5Y 5/4) loamy sand, dark grayish brown (2.5Y 4/2) when moist; single grain; loose; neutral.

The combined thickness of the A1 horizons ranges from 6 to 15 inches. The A11 horizon is dark gray or dark grayish brown. In places patchy clay films are on the vertical faces of the peds in the B2 horizon. Depth to loamy fine sand or coarser textured material ranges from 14 to 50 inches. In places the C horizon is calcareous below a depth of 40 inches and ranges from sandy loam to silty clay.

Anselmo soils are mapped with or are near Dunday, Ronson, Tuthill, and Vetal soils. They are less sandy than Dunday soils. Unlike Tuthill soils, Anselmo soils do not have horizons of increased clay content. Anselmo soils are deeper to sandstone than Ronson soils. Their horizons that are very dark grayish brown or darker when moist are thinner than those in Vetal soils.

Anselmo fine sandy loam, 2 to 5 percent slopes (AnB).—This soil is on uplands. It is gently undulating and is in areas that are irregular in shape. This soil has the profile described as representative for the series, but in eroded areas the surface layer is thinner. Surface runoff is slow, and most of the rainfall enters the soil.

Included with this soil in mapping are areas of Holt, Tassel, Tuthill, and Vetal soils. Holt and Tassel soils are on the convex, higher lying slopes and ridgetops. Tuthill soils are on some of the side slopes. Vetal soils, in swales, commonly are about 15 percent of any mapped area of this soil. Also included in mapping are areas of a soil that is similar to the Anselmo soil, but the subsoil has 3 percent or more clay than the surface layer. The other inclusions together are about 15 percent of the mapped areas.

Most of this soil is in native grass and is used for grazing. Corn, oats, and alfalfa are the main crops in cultivated areas. Control of soil blowing and improvement of content of organic matter are the main concerns of management in cultivated areas. Sandy range site; capability unit IIIe-8; pasture group H; windbreak group 5.

Anselmo fine sandy loam, 5 to 9 percent slopes (AnC).—This soil is on uplands. In some places it is undulating, and in other places the slopes are relatively long and smooth. It is in areas that are large and of irregular shape. The surface layer and the subsoil of this soil are slightly thinner than those in the profile described as representative for the series. In places soil blowing has severely eroded the soil, and small hummocks of blown soil make the surface uneven. Surface runoff is medium.

Included with this soil in mapping are areas of Holt, Tassel, Tuthill, and Vetal soils. Holt and Tassel soils are on some of the higher lying slopes and ridgetops. Tuthill soils are on some of the side slopes. Vetal soils are in swales. Also included in mapping are areas of a soil similar to the Anselmo soil, but the subsoil has 3 percent or more clay than the surface layer. Sandstone crops out near the crests of some slopes; these areas are shown on the soil map by the symbol for rock outcrop. These inclusions are about 15 percent of any mapped area of this soil.

Most areas are in native grass and are used for grazing. Oats and alfalfa are the main crops in cultivated areas. Control of soil blowing and water erosion are the main concerns of management. Sandy range site; capability unit IVe-8; pasture group H; windbreak group 5.

Anselmo-Ronson fine sandy loams, 5 to 9 percent slopes (ArC).—Anselmo soils are 40 percent of this complex, Ronson soils about 35 percent, and other soils 25 percent. These soils are on uplands. This complex is in areas that are fairly large and irregular in shape. The Anselmo soils are undulating and are on the lower lying slopes. They have a profile similar to that described as representative for the Anselmo series. Ronson soils are on the higher lying slopes and on ridgetops. Their surface layer and subsoil are thinner than those in the profile described as representative for the Ronson series. Fragments of sandstone are scattered on the surface and throughout the profile of the Ronson soil.

Included with these soils in mapping are areas of Tassel and Vetal soils. Tassel soils are on some of the ridgetops, and Vetal soils are in swales.

Available water capacity is low in Ronson soils. These soils are somewhat droughty.

Most areas are in native grass and are used for grazing. Spring-sown small grains and alfalfa are the main crops in cultivated areas. Control of soil blowing and water erosion and the conservation of moisture are the main concerns of management. Anselmo: Sandy range site; capability unit IVe-8; pasture group H; windbreak group 5. Ronson: Sandy range site; capability unit IVe-8; pasture group H; windbreak group 8.

Anselmo-Tassel fine sandy loams, 9 to 21 percent slopes (AtE).—Anselmo soils are 50 percent of this complex, Tassel soils 20 to 30 percent, and other soils 20 to 30 percent. This complex is in areas that are large and irregular in shape. In places it is on the sides of buttes. Slopes extend from tablelike uplands to deeply incised drain-

ageways. Anselmo soils are on the smooth side slopes. They have a thinner surface layer and subsoil than the profile described as representative for the Anselmo series. Tassel soils are on higher lying slopes, on ridgetops, and on the rims of buttes. Their profile is similar to that described as representative for the Tassel series.

Included with these soils in mapping are areas of Ronson, Tuthill, and Vetal soils. Ronson soils are the most extensive and are on convex ridges and lower lying slopes below the Tassel soils. Tuthill soils are on the lower lying slopes, and Vetal soils are in swales.

Surface runoff is medium to rapid. Water erosion and soil blowing are hazards if an adequate cover of plants is not maintained.

Almost all areas are in native grass and are used for grazing. Both of the soils of this complex are too erodible for cultivation, and the Tassel soils are too shallow for cultivation. Anselmo: Sandy range site; capability unit VIe-6; pasture group unassigned; windbreak group 10. Tassel: Shallow range site; capability unit VIe-10; pasture group unassigned; windbreak group 10.

Anselmo-Tuthill fine sandy loams, 9 to 21 percent slopes (AuE).—Anselmo soils are 35 percent of this complex, Tuthill soils 30 percent, Epping soils 20 percent, and other soils 15 percent. This complex is in areas that are long and narrow and are in canyons and draws on uplands. Anselmo soils are on the middle and lower parts of slopes and around the upper ends of the draws. Tuthill soils are on the smoother side slopes. Epping soils are on the steeper ridges and on the shoulders of the draws and canyons. These soils have a profile similar to that described as representative for their respective series.

Included with these soils in mapping are small areas of Vetal soils in swales. Also included are areas of similar soils that are well drained and that typically have a fine sandy loam surface layer and subsoil, but the subsoil contains more clay.

The soils of this complex are too steep and erodible for cultivation. All areas are in native grass and are used for grazing. Thin stands of ponderosa pine and bur oak are scattered throughout some of the areas west of Mission. Sandy range site; capability unit VIe-6; pasture group unassigned; windbreak group 10.

Anselmo-Vetal fine sandy loams, 0 to 2 percent slopes (AvA).—Anselmo soils are 50 to 60 percent of this complex, Vetal soils 25 to 35 percent, and other soils 15 to 25 percent. This complex is in areas that are fairly large and irregular in shape. It is on uplands. Anselmo soils are on slight rises or undulations and have a slightly thinner surface layer than that in the profile described as representative for the series. Vetal soils are in swales or slightly depressed areas. The combined thickness of the surface layer and the upper part of the subsoil is slightly less than that in the profile described as representative for the series.

Included with these soils in mapping are areas of Holt soils. They are near the crests of some of the slight rises. Also included in mapping are areas of a soil similar to the Anselmo soil, but the subsoil has 3 percent or more clay than the surface layer.

Surface runoff is slow, and water enters the soils readily. In some years the Vetal part of the complex receives additional moisture in the form of runoff from adjacent soils. Available water capacity is moderate to low.

About half of the acreage is cultivated. Spring-sown small grains, corn, and alfalfa are the main crops. Control of soil blowing is the main concern of management. Anselmo: Sandy range site; capability unit IIIe-7; pasture group H; windbreak group 5. Vetal: Sandy range site; capability unit IIIe-7; pasture group H; windbreak group 1.

Boyd Series

The Boyd series consists of sloping to steep, clayey soils that are moderately deep over shale. These soils formed in material weathered from the underlying soft shale and are on uplands.

In a representative profile the surface layer is dark-gray clay about 5 inches thick. The subsoil is about 21 inches thick. It is calcareous clay and is dark grayish brown in the upper part and grayish brown in the lower part. It is extremely hard when dry and extremely firm when moist. The underlying material is grayish-brown, calcareous clay. Bedded clay and soft shale are at a depth of 38 inches.

Boyd soils are well drained. Surface runoff is medium to rapid, and permeability is slow. Available water capacity is low. Fertility is medium, and the content of organic matter is moderate.

Most areas are in native grass and are used for grazing. If erosion is controlled, the more gently sloping soils are suited to small grains, row crops, and tame grasses.

Representative profile of Boyd clay from an area of Millboro silty clay, 5 to 9 percent slopes, in native grass; 1,584 feet south and 100 feet west of the NE. corner of sec. 1, T. 39 N., R. 26 W.:

A1—0 to 5 inches, dark-gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) when moist; moderate and strong, medium, granular structure; very hard, firm; neutral; abrupt, smooth boundary.

B21—5 to 9 inches, dark grayish-brown (2.5Y 4/2) clay, very dark gray (2.5Y 3/1) when moist; weak, medium, prismatic structure that parts to moderate, medium, blocky; extremely hard, extremely firm; calcareous; moderately alkaline; gradual, smooth boundary.

B22—9 to 26 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; dark-gray tonguing along cracks; moderate, coarse, blocky structure that parts to moderate, medium, blocky; extremely hard, extremely firm; calcareous; moderately alkaline; gradual, smooth boundary.

C1—26 to 38 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, coarse, blocky structure; extremely hard, extremely firm; a few pressure faces that have interlocking surfaces; a few, fine, segregations of lime; calcareous; moderately alkaline; gradual, smooth boundary.

C2—38 to 44 inches, grayish-brown (2.5Y 5/2) clay and weathered soft shale, dark grayish brown (2.5Y 4/2) when moist; common, fine, rust-colored mottles; bedded; extremely hard, extremely firm; a few salt crystals; calcareous; moderately alkaline; gradual, smooth boundary.

C3—44 to 60 inches, grayish-brown (2.5Y 5/2) shale, very dark grayish brown (2.5Y 3/2) when moist; common, fine, rust-colored mottles; bedded; shale plates ⅛ inch to 1/16 inch in thickness; calcareous; moderately alkaline.

The A1 horizon is clay or silty clay, and ranges from 4 to 6 inches in thickness. Depth to bedded shale ranges from 25 to 40 inches.

Boyd soils are near Hoven, Millboro, and Samsil soils.

Boyd soils are better drained than Hoven soils, and they do not have an A2 horizon that is typical of those soils. Boyd soils are not so deep over shale as Millboro soils, and they are deeper to shale than Samsil soils.

Boyd-Samsil clays, 6 to 19 percent slopes (BsD).—Boyd soils are about 70 percent of this complex, Samsil soils 25 percent, and other soils 5 percent. This complex is in areas that are large and irregular in shape. The areas extend from high tablelands to lower landforms. Boyd soils are on the side slopes and have a profile similar to that described as representative for the Boyd series, but bedded shale is at a depth of about 30 inches. Samsil soils are on the shoulders of draws and on ridgetops. They have a profile similar to that described as representative for the Samsil series, but depth to shale is about 15 inches.

Included with these soils in mapping are areas of Hoven and Millboro soils. Hoven soils are in depressed areas along narrow drainageways. Millboro soils are on some of the smoother and longer side slopes.

Surface runoff is medium to rapid, and permeability is slow. Available water capacity is low to very low.

Almost all areas are in native grass and are used for grazing. The slopes of these soils are too steep or too irregular for cultivation. In addition, Samsil soils are shallow to shale. Control of erosion is the main concern of management. Boyd: Clayey range site; capability unit VIe-4; pasture group I; windbreak group 10. Samsil: Shallow range site; capability unit VIs-3; pasture group unassigned; windbreak group 10.

Canyon Series

The Canyon series consists of rolling to hilly, loamy soils that are shallow over calcareous sandstone. These soils are on ridges and in rimrock areas on uplands.

In a representative profile the surface layer is dark grayish-brown loam about 2 inches thick. Below this layer is a transitional layer of light brownish-gray, calcareous loam about 7 inches thick. The underlying material is calcareous, very pale brown loam. Calcareous, very pale brown soft sandstone is at a depth of 12 inches.

Canyon soils are well drained to excessively drained. Surface runoff is rapid, and permeability is moderate. Available water capacity is very low. Fertility and the content of organic matter are low. Erosion is a severe hazard.

Canyon soils in Todd County are mapped only with Richfield soils.

Nearly all of the areas are in native grass and are used for grazing.

Representative profile of Canyon loam, in an area of Richfield and Canyon soils, 9 to 21 percent slopes, in native grass; 560 feet south and 530 feet east of the center of sec. 35, T. 38 N., R. 33 W.:

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; soft, very friable; a few, fine, sandstone fragments; moderately alkaline; abrupt, smooth boundary.

AC—2 to 9 inches, light brownish-gray (10YR 6/2) loam, grayish brown (10YR 5/2) when moist; weak, coarse, subangular blocky structure; soft, very friable; fine sandstone fragments make up 10 to 15 percent of mass, by volume; calcareous; moderately alkaline; clear, wavy boundary

C1—9 to 12 inches, very pale brown (10YR 8/3) loam, pale brown (10YR 6/3) when moist; massive; soft, very friable; many fine and coarse sandstone fragments; calcareous; moderately alkaline; clear, wavy boundary.

C2—12 to 30 inches, very pale brown (10YR 8/3) soft sandstone, pale brown (10YR 6/3) when moist; bedded; sandstone is weakly to moderately cemented, but can be dug with a spade; calcareous; moderately alkaline.

The A1 horizon is dark grayish brown or grayish brown, and ranges from 1 to 4 inches in thickness. In places it is calcareous. Depth to sandstone ranges from 4 to about 15 inches.

Canyon soils are near Tassel and Epping soils. They are less sandy than Tassel soils and less silty than Epping soils.

Chappell Series

The Chappell series consists of nearly level to gently sloping, loamy soils that are moderately deep over sand and gravel. These soils formed in alluvium and are on terraces along the major streams of the county.

In a representative profile the surface layer is dark-brown fine sandy loam about 5 inches thick. The subsoil is about 17 inches thick. It is very dark grayish-brown sandy loam in the upper part, dark-brown sandy loam in the middle part, and brown loamy sand in the lower part. It is slightly hard when dry and friable when moist. The lower part is soft when dry and loose when moist. The underlying material is white sand and gravel.

Chappell soils are somewhat excessively drained. Surface runoff is slow to medium. Permeability is moderately rapid in the solum and rapid in the underlying material. Available water capacity is low. Fertility is low to medium, and content of organic matter is moderate. Soil blowing is a severe hazard.

Formerly, many areas of these soils were cultivated. Now, most areas are in native grass and are used for grazing. Some areas have been seeded to tame grasses and are used for hay. In cultivated areas these soils are better suited to small grains than to row crops.

Representative profile of Chappell fine sandy loam in an area of Chappell-Anselmo fine sandy loams, 0 to 3 percent slopes, in native grass; 2,140 feet south and 750 feet west of the NE. corner of sec. 14, T. 37 N., R. 27 W.:

A1—0 to 5 inches, dark-brown (10YR 3/3) fine sandy loam, very dark brown (10YR 2/2) when moist; moderate, fine and medium, granular structure; soft, very friable; neutral; clear, smooth boundary.

B1—5 to 10 inches, very dark grayish-brown (10YR 3/2) sandy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure; slightly hard, friable; neutral; clear, smooth boundary.

B2—10 to 15 inches, dark-brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to moderate, medium and coarse, subangular blocky; slightly hard, friable; neutral; clear, smooth boundary.

B3—15 to 22 inches, brown (10YR 5/3) loamy sand, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; soft, loose; moderately alkaline; abrupt, smooth boundary.

IIC1—22 to 27 inches, white (10YR 8/1) sand and gravel, dark grayish brown (10YR 4/2) when moist; single grain; loose; gravel coated with lime; moderately alkaline; gradual boundary.

IIC2—27 to 60 inches, white (10YR 8/1) coarse sand and fine gravel, grayish brown (10YR 5/2) when moist; single grain; loose; calcareous; moderately alkaline.

The A1 horizon ranges from 5 to 8 inches in thickness. Depth to sand and gravel ranges from 18 to 24 inches. The sand and gravel in the IIC horizon is stratified and the proportion of gravel to sand varies. Much of the gravel consists of rounded fragments of soft siltstone or sandstone.

Chappell soils are mapped in complexes with Anselmo and Dix soils and are near Altvan and Ronson soils. They have calcareous material nearer the surface than Anselmo soils and, unlike Anselmo soils, they have gravel at a moderate depth in the underlying material. Chappell soils are deeper over gravel than Dix soils. Their B horizon is more sandy and less clayey than that in Altvan soils. Chappell soils are less calcareous than Ronson soils, and they are underlain by sand and gravel instead of by sandstone.

Chappell-Anselmo fine sandy loams, 0 to 3 percent slopes (CaA).—Chappell soils are 60 percent of this complex, Anselmo soils 30 percent, and other soils 10 percent. This complex is in areas that are fairly large and irregular in shape. The areas are on terraces along the major streams. Chappell and Anselmo soils are closely intermingled. The Chappell soil has the profile described as representative for the Chappell series. The surface layer of the Anselmo soil is slightly thinner than that in the profile described as representative for the Anselmo series.

Included with these soils in mapping are areas of Vetal and Whitelake soils in swales and in slight depressions.

Surface runoff is slow, and the soils absorb water readily. Chappell soils have low available water capacity and are droughty.

Many areas are in native grass and are used for grazing and for hay. Because the Chappell soil is droughty, it is better suited to spring-sown small grains and alfalfa than to row crops. Control of soil blowing, conservation of moisture, and the maintenance of fertility and content of organic matter are concerns of management. Chappell: Sandy range site; capability unit IIIe-9; pasture group D; windbreak group 6. Anselmo: Sandy range site; capability unit IIIe-7; pasture group H; windbreak group 5.

Chappell-Anselmo fine sandy loams, 3 to 5 percent slopes (CaB).—Chappell soils are 55 percent of this complex, Anselmo soils 25 percent, and other soils 20 percent. This complex is in areas that are long and narrow and is on terrace fronts or along drainageways on stream terraces. Slopes are slightly convex and commonly are short. Chappell soils are on the upper parts of slopes. They have a subsoil that is thinner than that in the profile described as representative for the Chappell series. Anselmo soils are on the lower parts of slopes. They have a profile similar to that described as representative for the Anselmo series.

Included with these soils in mapping are areas of Dix and Vetal soils. Dix soils are on convex, sloping areas near Chappell soils. Vetal soils are on foot slopes and in swales.

Surface runoff is medium. Chappell soils have low available water capacity, and they are droughty.

Nearly all areas are in native grass and are used for grazing. Alfalfa is the main crop in cultivated areas. Control of soil blowing and erosion and the conservation of moisture are the main concerns of management. Chappell: Sandy range site; capability unit IIIe-10; pasture group D; windbreak group 6. Anselmo: Sandy range site; capability unit IIIe-8; pasture group H; windbreak group 5.

Dawes Series

The Dawes series consists of deep, nearly level, silty soils that have a claypan subsoil. These soils formed in silty material and are on uplands.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsurface layer is light brownish-gray silt loam about 2 inches thick. The subsoil is mainly silty clay about 9 inches thick. It is very dark grayish brown in the upper part and light brownish gray in the lower part. It is extremely hard when dry and very firm when moist. The underlying material is calcareous, pale-brown silty clay loam and light-gray silt loam. White, calcareous, moderately cemented sandstone is at a depth of 40 inches.

Dawes soils are moderately well drained. Surface runoff is slow, and permeability is slow. Available water capacity is moderate. Fertility is medium, and the content of organic matter is moderate.

The Dawes soils in Todd County are mapped only with Richfield soils.

Most areas are in native grass and are used for grazing and for hay. Winter wheat and alfalfa are the main crops in cultivated areas.

Representative profile of Dawes silt loam in an area of Richfield-Dawes silt loams, 0 to 2 percent slopes, in native grass; 2,590 feet west and 450 feet south of the NE. corner of sec. 35, T. 37 N., R. 31 W.:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark gray (10YR 3/1) when moist; moderate, medium, granular structure; soft, very friable; neutral; clear, smooth boundary.

A2—7 to 9 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

B21t—9 to 12 inches, very dark grayish-brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, columnar structure that parts to strong, medium, blocky; extremely hard, very firm; thin continuous clay films on vertical faces of peds and thin patchy clay films on horizontal faces of peds; mildly alkaline; clear, smooth boundary.

B22t—12 to 15 inches, very dark grayish-brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) when moist; weak, fine, prismatic structure that parts to strong, medium, blocky; extremely hard, very firm; thick, continuous clay films on faces of peds; moderately alkaline; clear, smooth boundary.

B3—15 to 18 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, medium, blocky structure; very hard, very firm; thin patchy clay films on faces of peds; moderately alkaline; abrupt, smooth boundary.

C1—18 to 27 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; massive; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

C2—27 to 40 inches, light-gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

IIC3—40 to 60 inches, white (10YR 8/1) moderately cemented sandstone, light gray (10YR 7/2) when moist; bedded; calcareous; moderately alkaline.

The A1 and A2 horizons are silt loam or loam. Their combined thickness ranges from 6 to 12 inches. Depth to lime ranges from 15 to 20 inches. The C horizon is silt loam to a depth of 60 inches or more in some profiles.

Dawes soils are mapped in a complex with Richfield soils and are near Mosher soils. Dawes soils have a distinct A2

horizon and a slightly more clayey Bt horizon than Richfield soils. They are more silty and contain less sodium than Mosher soils.

Dix Series

The Dix series consists of gently sloping to sloping, loamy soils that are shallow to calcareous sand and gravel. These soils are on terrace remnants and on escarpments.

In a representative profile the surface layer is about 7 inches thick. It is very dark grayish-brown fine sandy loam in the upper part and dark grayish-brown sandy loam in the lower part. Below this layer is a transitional layer of dark grayish-brown sandy loam about 7 inches thick. It is hard when dry and friable when moist. The underlying material is calcareous, light-gray sand and gravel to a depth of 60 inches.

Dix soils are excessively drained. Surface runoff is medium, and permeability is rapid. Available water capacity is low to very low. Fertility is low. The content of organic matter is moderately low.

Most areas are in native grass and are used for grazing.

Representative profile of Dix fine sandy loam in an area of Dix-Chappell fine sandy loams, 3 to 9 percent slopes, in native grass; 200 feet south and 285 feet west of the NE. corner of sec. 4, T. 35 N., R. 29 W.:

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

A12—5 to 7 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable; mildly alkaline; clear, smooth boundary.

AC1—7 to 10 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that parts to weak, medium and fine, subangular blocky; hard, friable; thin patchy clay films on faces of peds; mildly alkaline; clear, smooth boundary.

AC2—10 to 14 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable; moderately alkaline; abrupt, wavy boundary.

IIC—14 to 60 inches, light-gray (10YR 7/2) sand and gravel, light brownish gray (10YR 6/2) when moist; single grain; loose; gravel makes up about 30 percent of mass, by volume; calcareous; moderately alkaline.

The A horizon ranges from 4 to 8 inches in thickness. Depth to gravel ranges from 6 to 18 inches.

Dix soils are more shallow to gravel than the Chappell soils with which they are mapped. Unlike the nearby Tassel soils, which are shallow to soft sandstone, Dix soils are shallow to sand and gravel.

Dix-Chappell fine sandy loams, 3 to 9 percent slopes (DcC).—Dix soils are 50 percent of this complex, Chappell soils 30 percent, and other soils 20 percent. This complex is in areas that are long and narrow and irregular in shape. It commonly is on terrace fronts or on low ridges or humps on terraces along the major streams. Dix soils are on the higher lying slopes, on ridgetops, and on the shoulders of draws. Dix soils have the profile described as representative for the Dix series. Chappell soils are on side slopes and have a profile similar to that described as representative for the Chappell series.

Included with these soils in mapping are Anselmo, Tuthill, and Vetal soils. They are on the lower lying slopes and in swales.

Surface runoff is medium. Available water capacity is low to very low, and these soils are droughty.

The areas of this complex are in native grass and are used for grazing. Dix soils are shallow to gravel and are not suitable for cultivation. Control of erosion and soil blowing and the conservation of moisture are concerns of management. Dix: Shallow to Gravel range site; capability unit VIs-4; pasture group unassigned; windbreak group 10. Chappell: Sandy range site; capability unit IIIe-10; pasture group D; windbreak group 6.

Doger Series

The Doger series consists of deep, nearly level to gently undulating, sandy soils on uplands. These soils formed in wind-deposited sandy material.

In a representative profile the surface layer is very dark grayish-brown loamy fine sand about 12 inches thick. Below this layer is a transitional layer of dark grayish-brown loamy fine sand about 14 inches thick. It is soft when dry and loose when moist. The underlying material is brown loamy fine sand in the upper 6 inches and pale-brown fine sand to a depth of 60 inches.

Doger soils are well drained to somewhat excessively drained. Surface runoff is very slow, and permeability is rapid. Available water capacity is low. Fertility is medium, and the content of organic matter is moderate. Soil blowing is a severe hazard.

The areas of Doger soils are used for crops and as rangeland. Small grains and alfalfa are the main crops in cultivated areas. Many areas that were formerly used for farming have been seeded to tame grass or left to revert to native grass.

Representative profile of Doger loamy fine sand, 0 to 3 percent slopes, in native grass; 500 feet south and 75 feet east of the NW. corner of sec. 13, T. 37 N., R. 29 W.:

A1—0 to 12 inches, very dark grayish-brown (10YR 3/2) loamy fine sand, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure that parts to weak, fine, granular; soft, loose; slightly acid; clear, smooth boundary.

AC1—12 to 19 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to weak, medium and fine, subangular blocky; soft, loose; slightly acid; gradual, smooth boundary.

AC2—19 to 26 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure that parts readily to single grain; soft, loose; neutral; gradual, wavy boundary.

C1—26 to 32 inches, brown (10YR 5/3) loamy fine sand, dark grayish brown (10YR 4/2) when moist; single grain; loose; neutral; gradual, wavy boundary.

C2—32 to 60 inches, pale-brown (10YR 6/3) fine sand, grayish brown (10YR 5/2) when moist; single grain; loose; neutral.

The A1 horizon ranges from 6 to 12 inches in thickness. The combined thickness of the A1 and AC horizons ranges from 20 to 36 inches. These horizons are very dark grayish brown or darker when moist. In a few places where these soils occur near areas of Holt or Tassel soils the lower part of the C horizon is calcareous.

Doger soils are near Anselmo, Dunday, Elsmere, and Vetal soils. They are more sandy than Anselmo and Vetal soils.

When moist, Doger soils are darker to a greater depth than Dunday and Elsmere soils. They do not have the water table that is present in the Elsmere soils.

Doger loamy fine sand, 0 to 3 percent slopes (DfA).—This soil is in areas that are fairly large and irregular in shape. Slight rises and undulations are common throughout the areas. This soil has the profile described as representative for the series.

Included with this soil in mapping are Anselmo, Dunday, and Vetal soils. Anselmo and Dunday soils are on the crests of some of the rises or undulations. Vetal soils are in swales. These inclusions are less than 20 percent of any mapped area of this soil.

The content of organic matter is moderate in this soil, and available water capacity is low. Soil blowing is a severe hazard.

Most areas are in native grass and are used for grazing. Spring-sown small grains and alfalfa are the main crops in cultivated areas. Control of soil blowing, conservation of moisture, and maintenance of content of organic matter are concerns of management. Sandy range site; capability unit IVe-9; pasture group H; windbreak group 5.

Doger-Dunday loamy fine sands, 3 to 6 percent slopes (DgB).—Doger soils are 65 percent of this complex, Dunday soils 20 percent, and other soils 15 percent. This complex is gently undulating and is on uplands. The areas are fairly large and irregular in shape. Doger soils are on side slopes. They have a profile similar to that described as representative for the Doger series. Dunday soils are on higher lying slopes and on the tops of rounded knolls. They have the profile described as representative for the Dunday series.

Included with these soils in mapping are Anselmo and Vetal soils in swales and low areas.

The content of organic matter is moderate to low in these soils. Available water capacity is low.

Most of the areas are in native grass and are used for grazing or for hay. Alfalfa is the main crop in cultivated areas. Control of soil blowing is the main concern of management. Doger: Sandy range site; capability unit IVe-9; pasture group H; windbreak group 5. Dunday: Sands range site; capability unit VIe-7; pasture group not assigned; windbreak group 7.

Duda Series

The Duda series consists of nearly level to gently undulating, sandy soils that are moderately deep over calcareous sandstone. These soils are on uplands. They formed in sandy material that was deposited or locally reworked by soil blowing.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 8 inches thick. Below this layer is about 6 inches of a transitional layer consisting of brown loamy fine sand. It is soft when dry and very friable when moist. The underlying material is pale-brown loamy sand. White, calcareous, moderately cemented sandstone is at a depth of 25 inches.

Duda soils are well drained. Surface runoff is slow to very slow, and permeability is moderately rapid. Available water capacity is very low. Fertility and the content of organic matter are low. Soil blowing is a severe hazard.

Most areas are in native grass and are used for grazing. Alfalfa is the main crop in cultivated areas. Many areas that were formerly farmed are seeded to native grasses.

Representative profile of Duda loamy fine sand, 0 to 6 percent slopes, in native grass; 1,100 feet south and 1,200 feet east of the NW. corner of sec. 4, T. 37 N., R. 27 W.:

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, granular structure that parts easily to single grain; soft, very friable; slightly acid; clear, smooth boundary.

AC—8 to 14 inches, brown (10YR 5/3) loamy fine sand, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure that parts easily to single grain; soft, very friable; neutral; gradual, wavy boundary.

C1—14 to 25 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 5/3) when moist; single grain; loose; neutral; clear, wavy boundary.

C2—25 to 60 inches, white (10YR 8/1) moderately cemented sandstone, light gray (10YR 7/2) when moist; light-gray (10YR 7/2) loamy fine sand in cracks, joints, and cleavages, light brownish gray (2.5Y 6/2) when moist; fine earth is mostly single grain and loose; calcareous; moderately alkaline; sandstone can be dug with a spade, but with difficulty.

The A1 horizon ranges from very dark grayish brown to grayish brown of 10YR hue in color, from loamy fine sand to sandy loam in texture, and from 6 to 10 inches in thickness. The AC horizon is brown or grayish brown and ranges from 5 to 8 inches in thickness. In places fine sandstone fragments are throughout the profile above the sandstone. Sandstone is at a depth of 20 to 40 inches. It commonly is moderately cemented, but in places it is weakly cemented, and there are only a few scattered fragments of moderately cemented sandstone.

Duda soils are near Anselmo, Dunday, Holt, and Ronson soils. They are more sandy than Anselmo, Holt, and Ronson soils. They are not so deep over calcareous sandstone as Dunday soils.

Duda loamy fine sand, 0 to 6 percent slopes (DlB).—This is the only Duda soil mapped in the county. It is on uplands. In places it is gently undulating. The areas are fairly large and irregular in shape.

Included with this soil in mapping are Doger and Tassel soils. Doger soils are on the lower side slopes and in low areas. Tassel soils are on the tops of ridges and knolls. These inclusions are 20 to 30 percent of any mapped area of this soil.

Available water capacity is very low. Fertility and the content of organic matter are low.

Most areas of this soil are in native grass and are used for hay or for grazing. Alfalfa is the main crop in cultivated areas. Control of soil blowing, conservation of moisture, and improvement of fertility and the content of organic matter are concerns of management. Sands range site; capability unit IVe-9; pasture group H; windbreak group 7.

Dunday Series

The Dunday series consists of deep, nearly level to gently undulating, sandy and loamy soils on uplands and in stream valleys. These soils formed in wind-deposited sands.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 13 inches thick. Below this layer is a transitional layer of loose, grayish-brown loamy fine sand about 9 inches thick. The under-

lying material is pale-brown fine sand to a depth of 60 inches.

Dunday soils are somewhat excessively drained. Surface runoff is very slow, and permeability is rapid. Available water capacity is low. Fertility is low, and the content of organic matter is moderately low to low. Soil blowing is a severe hazard.

Most areas are in native grass and are used for grazing. Alfalfa is the main crop in cultivated areas. Many areas that were formerly farmed are seeded to tame grass or are left to revert to native grass.

Representative profile of Dunday loamy fine sand, from an area of Doger-Dunday loamy fine sands, 3 to 6 percent slopes; 600 feet east and 200 feet north of the SW. corner of sec. 9, T. 37 N., R. 27 W.:

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure that parts to single grain; soft, very friable; neutral; clear, smooth boundary.

A12—4 to 13 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure that parts to weak, fine, subangular blocky; soft, very friable; neutral; clear, smooth boundary.

AC—13 to 22 inches, grayish-brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to single grain; loose; neutral; gradual, smooth boundary.

C—22 to 60 inches, pale-brown (10YR 6/3) fine sand; brown (10YR 5/3) when moist; single grain; loose; mildly alkaline.

The A horizon has colors of 10YR hue that range from very dark grayish brown to grayish brown. The texture is loamy fine sand or fine sandy loam. The combined thickness of the A horizons ranges from 8 to 18 inches. The AC horizon is brown or grayish brown. In places calcareous sandstone is at a depth of 40 to 60 inches.

Dunday soils are mapped with Doger and Valentine soils, and they are near Anselmo and Duda soils. Dunday soils have a thicker A horizon than Valentine soils, but the horizons that are very dark grayish brown or darker when moist are thinner than those of the Doger soils. Dunday soils are more sandy than Anselmo soils. Unlike Duda soils, they are not underlain by calcareous sandstone at a moderate depth.

Dunday fine sandy loam, 0 to 2 percent slopes (DuA).—This soil is on low terraces along streams. The areas are long and narrow. The surface layer is fine sandy loam and is slightly thicker than that in the profile described as representative for the series.

Included with this soil in mapping are Doger soils in low areas. Also included is Dunday loamy fine sand on narrow low ridges, about 1 to 3 feet high, that are parallel to the stream channel. These inclusions are less than 10 percent of any mapped area of this soil.

Surface runoff is very slow on this soil. Available water capacity is low. Soil blowing is a hazard.

Most areas are in native grass and are used for grazing and for hay. Bur oak, ash, and American elm grow on some areas near streams. Alfalfa is the main crop in cultivated areas. Control of soil blowing is the main concern of management. Sandy range site; capability unit IVe-9; pasture group H; windbreak group 7.

Dunday loamy fine sand, 0 to 2 percent slopes (DsA).—This soil is on low terraces along the major streams in the county. Stream channels as much as 20 feet wide and 10 feet deep meander through some areas. This soil formed in coarser sand than the soil whose profile is described as representative for the series, and its underlying material is more stratified. In places there are small eroded spots. The surface layer is fine sandy loam in some of the lower lying areas.

Included with this soil in mapping are Doger soils on the outer edges of the terraces adjacent to the higher lying uplands. These inclusions are less than 10 percent of any mapped area of this soil.

Flooding is a hazard in some years, but it is of short duration. The content of organic matter is moderately low to low. Soil blowing is a severe hazard.

Most areas are in native grass and are used for grazing. Scattered thin stands of bur oak, ash, and American elm are in some areas. Alfalfa is the main crop in cultivated areas. Control of soil blowing and the improvement of fertility and of content of organic matter are concerns of management. Sands range site; capability unit IVe-9; pasture group H; windbreak group 7.

Elsmere Series

The Elsmere series consists of deep, nearly level, sandy soils that have a fluctuating water table. These soils formed in sandy material reworked by soil blowing. They are on bottom lands and in valleys and depressions of the Sandhills.

In a representative profile the surface layer is dark grayish-brown and very dark grayish-brown loamy fine sand about 15 inches thick. Below this layer is a transitional layer of light brownish-gray, loose, loamy fine sand, about 6 inches thick. The underlying material is calcareous, gray loamy fine sand and sandy loam. Calcareous, pale-brown loamy fine sand is at a depth of 50 inches.

Elsmere soils are somewhat poorly drained. Surface runoff is slow, and permeability is rapid. Available water capacity is low. Depth to the water table is 2 to 6 feet. The water table is within 5 feet of the surface during most of the growing season. Fertility is medium, and the content of organic matter is moderately low. Soil blowing is a severe hazard.

Most areas are in native grass and are used for hay and for grazing. Alfalfa is the main crop in cultivated areas.

Representative profile of Elsmere loamy fine sand, 0 to 3 percent slopes; 150 feet west and 575 feet north of new road into Nebraska on State line, sec. 24, T. 35 N., R. 31 W.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; soft, very friable; mildly alkaline; clear, smooth boundary.

A12—6 to 15 inches, very dark grayish-brown (10YR 3/2) loamy fine sand, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; soft, very friable; mildly alkaline; abrupt, smooth boundary.

AC—15 to 21 inches, light brownish-gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; loose; mildly alkaline; abrupt, smooth boundary.

C1—21 to 37 inches, gray (10YR 6/1) loamy fine sand, grayish brown (10YR 5/2) when moist; single grain; loose; calcareous; moderately alkaline; abrupt, smooth boundary.

C2b—37 to 41 inches, gray (N 5/0) sandy loam, very dark gray (10YR 3/1) when moist; light-gray (10YR 7/1) and gray (10YR 6/1) mottles; massive; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.
C3—41 to 50 inches, gray (N 6/0) sandy loam, dark gray (N 4/0) when moist; massive; very hard, friable; calcareous; moderately alkaline; clear, smooth boundary.
C4—50 to 60 inches, pale-brown (10YR 6/3) loamy fine sand, grayish brown (10YR 5/2) when moist; single grain; slightly hard, loose; calcareous; moderately alkaline.

The A1 horizon ranges from sandy loam to loamy fine sand in texture and from 8 to 17 inches in thickness. The mottles in the C horizon commonly are transient, and some disappear when the soil material is dry.

Elsmere soils are near Loup and Doger soils. They are better drained than the Loup soils. Elsmere soils are less well drained than Doger soils, and, unlike those soils, they have a water table within 6 feet of the surface.

Elsmere loamy fine sand, 0 to 3 percent slopes (ElA).—This soil is on bottom lands. It is in areas that are long and narrow and irregular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are Dunday, Loup, and Wann soils. Dunday soils are on the outer edges of the mapped areas and on slight rises or undulations. Loup soils are in low areas that are within the Sandhills. Wann soils are in low areas that are outside the Sandhills. These inclusions are as much as 35 percent of any mapped area of this soil.

The content of organic matter is moderately low. Soil blowing is a severe hazard. During wet years the high water table is a limitation to use.

Many areas are in native grass and are used for hay or for grazing. Spring-sown small grains and alfalfa are the main crops in cultivated areas. Control of soil blowing is the main concern of management. Subirrigated range site; capability unit IVe-10; pasture group A; windbreak group 2.

Epping Series

The Epping series consists of sloping to moderately steep, calcareous, silty soils that are shallow to siltstone. These soils are on uplands. They formed in material weathered from the underlying siltstone.

In a representative profile the surface layer is pale-brown silt loam, about 2 inches thick. Below this layer is a transitional layer of pale-brown silt loam about 5 inches thick. It is slightly hard when dry and friable when moist. Bedded white siltstone and very pale brown silt loam are at a depth of 7 inches.

Epping soils are well drained to somewhat excessively drained. Surface runoff is rapid, and permeability is moderate. Available water capacity is very low. Fertility and the content of organic matter are low.

Epping soils in Todd County are mapped only with Kadoka, Keith, and Keota soils.

Most areas are in native grass and are used for grazing. The native vegetation consists of short and mid grasses.

Representative profile of Epping silt loam, from an area of Keota-Epping silt loams, 9 to 21 percent slopes; 2,390 feet west and 150 feet south of the NE. corner of sec. 32, T. 39 N., R. 30 W.:

A1—0 to 2 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.
AC—2 to 7 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, blocky structure; slightly hard, friable; calcareous; moderately alkaline; abrupt, smooth boundary.
C1—7 to 17 inches, white (10YR 8/2) siltstone and very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) and brown (10YR 5/3) when moist; massive; hard, friable: many fine to coarse siltstone fragments make up 60 percent of the mass, by volume; calcareous; moderately alkaline; gradual boundary.
C2—17 to 50 inches, very pale brown (10YR 7/3) siltstone, brown (10YR 5/3) when moist; bedded; calcareous; moderately alkaline.

The A1 horizon ranges from light brownish gray to pale brown in 10YR hue. It is silt loam or loam and ranges from 1 to 3 inches in thickness. In places the A1 horizon is noncalcareous. Fragments of siltstone commonly are on the surface and throughout the profile. Depth to siltstone ranges from 7 to 18 inches.

Epping soils are mapped with Kadoka and Keota soils, and are near Canyon, Orella, and Tassel soils. Epping soils are more shallow to siltstone than Kadoka and Keota soils. They are more silty than Canyon and Tassel soils and are less clayey than Orella soils.

Gannett Series

The Gannett series consists of deep, nearly level, loamy soils that have a high water table. These soils formed in sandy material laid down by wind or by water. They are on bottom lands within the Sandhills.

In a representative profile about 5 inches of very dark grayish-brown peat and very dark gray muck overlies a surface layer of dark-gray sandy loam about 10 inches thick. The underlying material is gray fine sand to a depth of 60 inches.

Gannett soils are very poorly drained. Surface runoff is very slow to ponded, and permeability is rapid. Available water capacity is low, but the water table generally is at or near the surface. Fertility is medium, and the content of organic matter is high.

These soils are used for native hay or for grazing. The native vegetation consists of tall grasses and sedges.

Representative profile of Gannett sandy loam; 300 feet south and 200 feet east of the center of sec. 5, T. 35 N., R. 31 W.:

O1—5 inches to 2, very dark grayish-brown (10YR 3/2) peat that is 50 percent recognizable plant remains, very dark brown (10YR 2/2) when moist; neutral; abrupt, smooth boundary.
O2—2 inches to 0, very dark gray (10YR 3/1) muck that is about 75 percent organic matter; black (10YR 2/1) when moist; neutral; clear, smooth boundary.
A1g—0 to 10 inches, dark-gray (10YR 4/1) sandy loam, very dark gray (10YR 3/1) when moist; single grain; loose; mildly alkaline; abrupt, smooth boundary.
Cg—10 to 60 inches, gray (10YR 5/1) fine sand, dark gray (10YR 4/1) when moist; single grain; loose; free water at a depth of 13 inches.

The O horizon ranges from 1 to 6 inches in thickness. The A horizon is fine sandy loam to loamy fine sand. The C horizon commonly is stratified with layers of finer textured material.

Gannett soils are more poorly drained and have thicker O horizons than the nearby Loup soils.

Gannett sandy loam (0 to 1 percent slopes) (Ge).—This is the only Gannett soil mapped in the county. It is

on bottom lands in the Sandhills. The areas are long and narrow.

Included with this soil in mapping are areas of Loup soils, Peaty muck, and marshy areas where water ponds. Loup soils are on the higher parts of the mapped areas. Peaty muck and the marshy areas are on the lowest part. The included areas are as much as 30 percent of any area of this soil.

The high water table limits the use of this soil, and wetness is the main concern of management. The soil is too wet for cultivation. All areas are in native grass and are used for hay or for grazing. Wetland range site; capability unit Vw-3; pasture group B; windbreak group 10.

Goshen Series

The Goshen series consists of deep, nearly level, silty soils on flats and in swales on uplands. These soils formed in alluvium washed in from adjacent soils.

In a representative profile the surface layer is about 11 inches thick. It is dark-gray silt loam in the upper part and dark grayish-brown silty clay loam in the lower part. The subsoil is silty clay loam about 27 inches thick. It is grayish brown in the upper and middle parts and is dark grayish brown in the lower part. The middle part is very hard when dry and very firm when moist. The underlying material is pale-brown silty clay loam and very pale brown, calcareous silt loam.

Goshen soils are moderately well drained to well drained. Surface runoff is slow, and permeability is moderate. Many of the areas receive runoff from adjacent soils. Available water capacity is high. Fertility and the content of organic matter are high.

Many areas are cultivated. Winter wheat and alfalfa are the main crops. Corn, oats, and sorghum also are grown. Other areas are in native grass and are used for grazing and for hay.

Representative profile of Goshen silt loam; 2,590 feet south and 1,584 feet west of the NE. corner of sec. 26, T. 39 N., R. 32 W.:

A11—0 to 4 inches, dark-gray (10YR 4/1/) silt loam, black (10YR 2/1) when moist; weak, thick, platy structure that parts to moderate, medium, granular; soft, very friable; mildly alkaline; clear, smooth boundary.

A12—4 to 11 inches, dark grayish-brown (10YR 4/2) light silty clay loam, very dark brown (10YR 2/2) when moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; soft, friable; mildly alkaline; clear, smooth boundary.

B21t—11 to 16 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to strong, fine, subangular blocky; slightly hard, firm; thin, continuous, clay films on faces of peds; mildly alkaline; clear, smooth boundary.

B22t—16 to 30 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to strong, fine and medium, blocky; very hard, very firm; moderately thick, continuous, clay films on vertical faces of peds; mildly alkaline; clear, smooth boundary.

B3—30 to 38 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, subangular blocky structure; slightly hard, firm; mildly alkaline; clear, smooth boundary.

C1—38 to 42 inches, pale-brown (10YR 6/3) light silty clay loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, firm; mildly alkaline; abrupt, smooth boundary.

C2—42 to 60 inches, very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, firm; moderately alkaline; calcareous.

Combined thickness of the A and B horizons that have colors of very dark grayish brown or darker when moist is 20 to 40 inches. Buried horizons are common in the lower part of the B horizon. In places siltstone is between a depth of 40 and 60 inches.

Goshen soils are near Kadoka, Keith, Keya, and Vetal soils. Goshen soils have thicker A and B horizons than Kadoka and Keith soils. They are more silty than Keya and Vetal soils.

Goshen silt loam (0 to 3 percent slopes) (Gh).—This is the only Goshen soil mapped in the county. It is on foot slopes and in swales on uplands.

Included with this soil in mapping are Kadoka, Keith, and Richfield soils. These inclusions are on the outer edges of the areas and are less than 10 percent of any mapped area of this soil.

Surface runoff is slow, and the areas receive water runoff from adjacent soils. Except in years of above-average precipitation, this additional source of moisture is beneficial rather than detrimental. Conservation of moisture is a concern of management in other years. Maintenance of tilth, fertility, and the content of organic matter are other concerns of management.

Many areas are cultivated. Winter wheat and alfalfa are the main crops, but the soil is well suited to all crops grown in the county. Overflow range site; capability unit IIc-3; pasture group K; windbreak group 1.

Gravelly Land

Gravelly land (9 to 25 percent slopes) (Gr) consists of mixed gravelly soils on ridges and high peaks on uplands. The areas are long and narrow, and are irregular in shape. Slopes are convex. About half the acreage is gravelly soils that are shallow to gravel, and in places gravel is on the surface. The gravel is stratified and contains layers of coarse sand and, in places, layers of silt. The gravel is hard, quartzitic, and rounded.

Included with Gravelly land in mapping are Altvan, Keya, and Tuthill soils. Altvan and Tuthill soils are on the middle and lower parts of slopes. Keya soils are in swales.

Gravelly land is low to very low in available water capacity and is droughty.

All areas of Gravelly land are in native grass and are not suitable for cultivation. The areas are used mainly for grazing. Conservation of moisture and control of erosion are the main concerns of management. In most places Gravelly land is a good source of gravel for road construction. Very Shallow range site; capability unit VIIs-4; pasture group unassigned; windbreak group 10.

Holt Series

The Holt series consists of nearly level to undulating, loamy soils that are moderately deep over sandstone. These soils are on uplands. They formed in material weathered from the underlying soft, calcareous sandstone.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 6 inches thick. The subsoil is about 16 inches thick. It is sandy loam that is

dark grayish brown in the upper part, grayish brown in the middle part, and light gray in the lower part. It is slightly hard when dry and friable when moist. White, weakly to moderately cemented, calcareous sandstone (fig. 7) is at a depth of 22 inches. Light-gray loamy fine sand is in cracks and joints in the upper part of the sandstone.

Holt soils are well drained. Surface runoff is slow to medium, and permeability is moderately rapid. Available water capacity is low to very low. Fertility is medium to low. The content of organic matter is moderate. Soil blowing and water erosion are hazards.

Many areas of Holt soils were formerly cultivated but have been seeded to tame grass or have reverted to native grass. Small grains and alfalfa are the main crops grown in cultivated areas.

Figure 7.—**Profile of Holt fine sandy loam, 0 to 3 percent slopes. The lower part of the subsoil, above the soft sandstone, contains fragments of sandstone.**

Representative profile of Holt fine sandy loam, 0 to 3 percent slopes; 1,740 feet west and 100 feet north of the SE. corner of sec. 10, T. 37 N., R. 29 W.:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; soft, very friable; neutral; clear, smooth boundary.

B21t—6 to 11 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable; mildly alkaline; gradual, smooth boundary.

B22t—11 to 17 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; slightly hard, friable; thin, patchy, clay films on faces of peds; mildly alkaline; gradual, smooth boundary.

B3—17 to 22 inches, light-gray (10YR 7/2) light sandy loam, grayish brown (10YR 5/2) when moist; very weak, medium and fine, subangular blocky structure and single grain; slightly hard, friable; common weakly cemented sandstone fragments ½ to 3 inches in diameter; mildly alkaline; clear, smooth boundary.

C1—22 to 27 inches, white (10YR 8/1), weakly to moderately cemented sandstone, and light-gray (10YR 7/1) loamy fine sand in cracks, joints, and other cleavages, grayish brown (10YR 5/2) when moist; fine earth comprises 40 percent of horizon, by volume, and it is single grain and loose; calcareous; moderately alkaline; abrupt, wavy boundary.

C2—27 to 60 inches, white (10YR 8/1), moderately cemented sandstone, light gray (10YR 6/1) when moist; calcareous; strongly alkaline; can be dug with a spade, but with difficulty.

The A horizon ranges from 4 to 7 inches in thickness. Depth to calcareous sandstone ranges from 20 to 36 inches. The sandstone consists of weakly to strongly cemented loamy sand and sandy loam.

Holt soils are near Anselmo, Ronson, Tassel, Tuthill, and Vetal soils. They are shallower to sandstone than the Anselmo, Tuthill, and Vetal soils, and they have less clayey B horizons than the Tuthill soils. Holt soils are deeper to sandstone than Tassel soils. Unlike Ronson soils, they have B21t and B22t horizons.

Holt fine sandy loam, 0 to 3 percent slopes (HfA).—This soil is on uplands. It has very gentle undulations. The areas are irregular in shape, and the drainage pattern is poorly defined. This soil has the profile described as representative for the series, but in eroded areas the surface layer is thinner.

Included with this soil in mapping are Anselmo, Tassel, and Vetal soils. Anselmo soils are on the sides of some of the undulations. Tassel soils are on tops of the rises or undulations. Vetal soils are in swales and depressed areas. These inclusions are less than 15 percent of any mapped area of this soil.

Surface runoff is slow, and permeability is moderately rapid. Available water capacity is low to very low, and the soil is droughty.

Small grains and alfalfa are the main crops in cultivated areas. This soil is better suited to these crops than to corn and sorghum. Control of soil blowing, conservation of moisture, and maintenance of the content of organic matter are concerns of management. Sandy range site; capability unit IIIe-9; pasture group H; windbreak group 5.

Holt-Vetal fine sandy loams, 3 to 9 percent slopes (HlC).—Holt soils are 40 percent of this complex, Vetal

soils 20 percent, and other soils about 25 percent. This complex is gently undulating to undulating. The areas are large and are irregular in shape. Slopes are short, and the drainage pattern is well defined. Holt soils are on the upper part of the slopes. They have a profile similar to that described as representative for the Holt series, but depth to lime is about 15 inches, and depth to sandstone is slightly less. Vetal soils are on the lower part of slopes and in swales. Their profile is similar to that described as representative for the Vetal series.

Included with these soils in mapping are Anselmo, Tassel, and Tuthill soils. Tuthill soils are the most extensive of these inclusions, and they are on side slopes. Anselmo soils are on foot slopes and Tassel soils are on ridges. Sandstone crops out on some of the higher ridges. These areas are shown on the soil map by a symbol for rock outcrops.

Surface runoff is medium on the Holt part of the complex. Water erosion and soil blowing are hazards in these areas. Available water capacity is moderate, and fertility is high on the Vetal soils. Use of the complex, however, is governed by the Holt soils, which are droughty and medium to low in fertility.

Most areas are in native grass and are used for grazing or for hay. Spring-sown small grains and alfalfa are the main crops but some corn is also grown. Control of soil blowing and water erosion, conservation of moisture, and maintenance of fertility and the content of organic matter are concerns of management. Holt: Sandy range site; capability unit IVe-8; pasture group H; windbreak group 5. Vetal: Sandy range site; capability unit IIIe-8; pasture group H; windbreak group 1.

Hoven Series

The Hoven series consists of deep, nearly level or gently sloping, silty soils that have claypan subsoils. These soils are on uplands on flats and in depressions. They formed in alluvium washed in from adjacent soils.

In a representative profile the surface layer is dark grayish-brown silt loam about 2 inches thick. Below this layer is a subsurface layer of gray silt loam about 4 inches thick. The subsoil is about 20 inches thick. It is gray clay in the upper part and gray clay loam in the lower part. It is extremely hard when dry and extremely firm when moist. The underlying material is pale-brown sandy clay loam to a depth of 60 inches.

Hoven soils are poorly drained. Surface runoff ponds and remains until it evaporates. Permeability is very slow. Available water capacity is high, but the soil releases moisture slowly to plants. The content of organic matter is moderate, and fertility is low.

Most areas are in native grass and are used for grazing. Some of the better drained areas are cultivated along with adjacent soils.

Representative profile of Hoven silt loam, 0 to 1 percent slopes; 2,100 feet west and 100 feet south of the NE. corner of sec. 4, T. 38 N., R. 27 W.:

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam, black (10YR 2/1) when moist; moderate, medium, granular structure; soft, very friable; neutral; clear, smooth boundary.

A21—2 to 4 inches, gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; weak, coarse, blocky structure that parts to weak, thin, platy; slightly hard, very friable; neutral; clear, smooth boundary.

A22—4 to 6 inches, gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; weak, thick, platy structure that parts to moderate, medium and coarse, granular; soft, very friable; neutral; abrupt, wavy boundary.

B21t—6 to 9 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) when moist; moderate, medium and coarse, columnar structure; thin, patchy, clay films; extremely hard, extremely firm; mildly alkaline; clear, wavy boundary.

B22t—9 to 16 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) when moist; weak, coarse, prismatic structure that parts to moderate, medium and coarse, blocky; extremely hard, extremely firm; thin, patchy, clay films; mildly alkaline; clear, wavy boundary.

B3—16 to 26 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) when moist; weak, coarse, blocky structure that parts to moderate, medium and fine blocky; extremely hard, extremely firm; mildly alkaline; clear, wavy boundary.

IIC1—26 to 35 inches, pale-brown (10YR 6/3) sandy clay loam, dark grayish brown (10YR 4/2) when moist, weak, coarse, blocky structure; hard, firm; thin patchy clay films; mildly alkaline; abrupt, wavy boundary.

IIC2ca—35 to 40 inches, pale-brown (10YR 6/3) sandy clay loam, grayish brown (10YR 5/2) when moist; many coarse, rust-colored mottles; massive; hard hard, firm, calcareous; moderately alkaline; clear, smooth boundary.

IIC3—40 to 60 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10 YR 5/3) when moist; many coarse rust-colored motles; massive; slightly hard, friable, neutral.

In places the A1 horizon is absent. The A2 horizon ranges from 1 to 5 inches in thickness. Visible salts are in the B3 and C horizons in some profiles. The C horizon ranges from clay loam to sandy clay loam in texture.

Hoven soils are more poorly drained than Minatare, Mosher Wanblee, and Wortman soils, which have similar profiles. The A1 horizon of Hoven soils is thinner than that in Mosher and Wortman soils. The B horizon of Hoven soils is thicker than that in Minatare and Wanblee soils.

Hoven silt loam, 0 to 1 percent slopes (HmA).—This soil is in depressions on uplands. Areas range from 2 to 40 acres in size and commonly are circular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are narrow bands of Mosher soils on the outer edges of the depressions.

Surface runoff ponds on this soil in spring and remains until evaporated. Penetration of moisture into the soil is very slow, and the dense claypan subsoil releases moisture slowly to plants. The soil is droughty during dry periods.

Most areas are in native grass and are used for grazing. Low spots in the areas commonly lack a cover of plants. Closed Depression range site; capability unit VIs-1; pasture group B; windbreak group 10.

Hoven silt loam, drained, 0 to 5 percent slopes (HnA).—This soil is on flats and along drainageways on uplands. Most areas on flats are broad and irregular in shape, but some areas are long and narrow. The surface is uneven because there are small mounds and small depressions ranging from 2 feet to several feet in diameter.

Included with this soil in mapping are Mosher soils around the edges of the mapped areas. These inclusions are less than 20 percent of any mapped area of this soil.

Surface runoff ponds only in the small, low spots between the mounds. Penetration of moisture into the soil is very slow, and the dense claypan subsoil releases moisture slowly to plants.

All areas are in native grass and are used for grazing. Many of the low spots are bare of vegetation. Thin Claypan range site; capability unit VIs-1; pasture group unassigned; windbreak group 10.

Huggins Series

The Huggins series consists of moderately deep, nearly level to sloping, silty soils that have a clayey subsoil. These soils formed in material weathered from the underlying soft siltstone (fig. 8) and are on uplands.

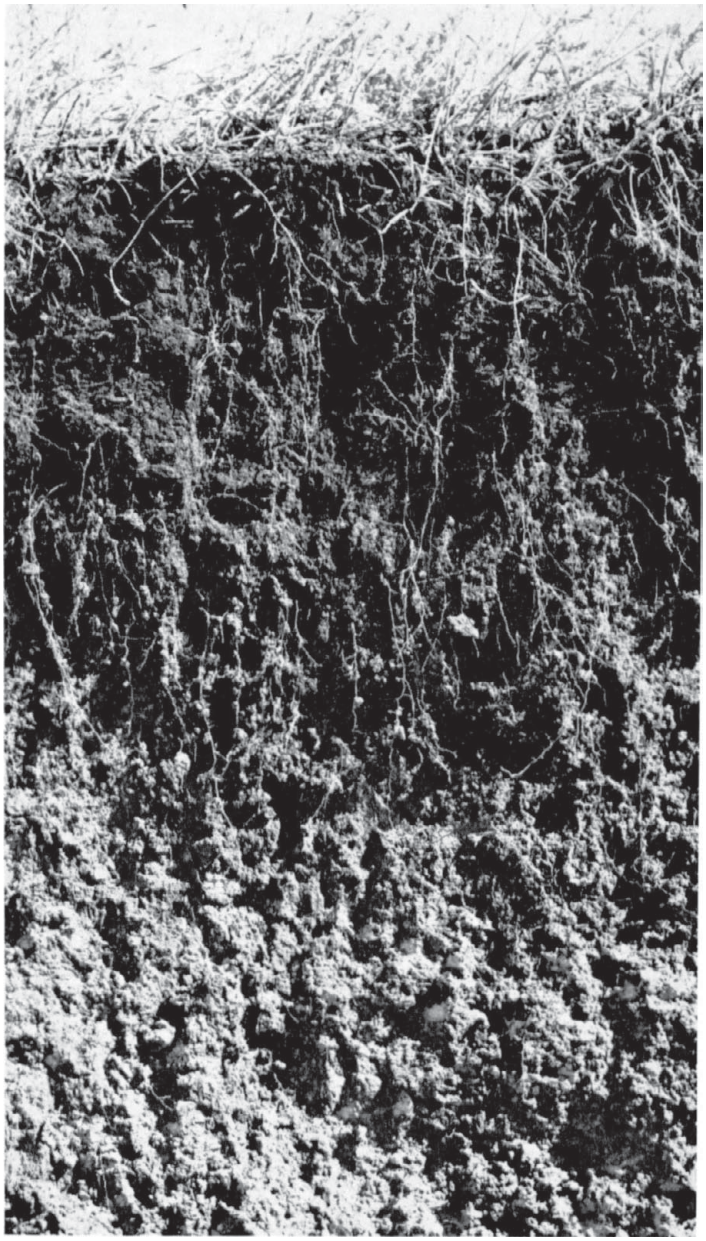


Figure 8.—**Profile of Huggins silt loam, 0 to 2 percent slopes. Siltstone is at a depth of about 26 inches.**

In a representative profile the surface layer is gray silt loam about 5 inches thick. The subsoil is grayish-brown silty clay loam and silty clay about 16 inches thick. The middle and lower parts are very hard when dry and friable when moist. The underlying material is pinkish-gray gravelly clay loam. Very pale brown, hard siltstone is at a depth of 26 inches.

Huggins soils are well drained. Surface runoff is medium, and permeability is moderately slow. Available water capacity is low. The content of organic matter is moderate, and fertility is medium. Erosion is a hazard in sloping areas.

Many areas are in native grass and are used for grazing. Winter wheat and alfalfa are the main crops in cultivated areas. Spring-sown small grains are also grown. This soil is better suited to early-maturing crops than to corn.

Representative profile of Huggins silt loam, 0 to 2 percent slopes, in native grass; 2,000 feet north and 900 feet east of the SW. corner of sec. 32, T. 39 N., R. 30 W.:

A1—0 to 5 inches, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; hard, friable; neutral; clear, wavy boundary.

B21t—5 to 10 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, prismatic structure that parts to weak, medium, subangular blocky; hard, friable; thin patchy clay films on faces of peds; mildly alkaline; clear, wavy boundary.

B22t—10 to 17 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, blocky; thin continuous clay films on faces of peds; mildly alkaline; clear, wavy boundary.

B3t—17 to 21 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; very hard, friable; a few flat roots; thin, continuous, clay films on faces of peds; about 20 percent, by volume, is siltstone particles, 1 millimeter to 25 millimeters in diameter; mildly alkaline; abrupt boundary.

C1—21 to 26 inches, pinkish-gray (7.5YR 6/2) gravelly clay loam, dark brown (7.5YR 4/3) when moist; weak, medium and fine, subangular blocky structure; very hard, friable; 50 to 80 percent, by volume, is siltstone fragments; a few roots; mildly alkaline; gradual boundary.

C2—26 to 60 inches, very pale brown (10YR 8/3) hard siltstone, brown (10YR 5/3) when moist; calcareous; moderately alkaline; difficult to chip with a spade.

The A horizon is silt loam or silty clay loam and ranges from 4 to 7 inches in thickness. The B2t horizon ranges from 10 to 15 inches in thickness. Depth to siltstone ranges from 20 to 30 inches. In places the siltstone is noncalcareous.

Huggins soils are near Epping, Kadoka, Shena, and Wortman soils. Huggins soils are deeper over siltstone than Epping and Shena soils. Their B horizons are more clayey than Kadoka soils. Unlike Wortman soils, they do not have an A2 horizon, and they have a prismatic structure, rather than columnar, in the upper part of the B horizon.

Huggins silt loam, 0 to 2 percent slopes (HuA).—This soil is on uplands in areas of moderate size and of irregular shape. Slopes are long and smooth. This soil has the profile described as representative for the series.

Included with this soil in mapping are Goshen soils in swales and Wortman soils in slightly depressed areas. These inclusions are about 15 percent of any mapped area of this soil.

Available water capacity is low, and the soil is somewhat droughty. The underlying siltstone restricts the penetration of roots.

About half of the acreage is cultivated. Winter wheat and alfalfa are the main crops. Conservation of moisture and maintenance of tilth are concerns of management. Clayey range site; capability unit IIIs-5; pasture group E; windbreak group 4.

Huggins-Kadoka silt loams, 2 to 9 percent slopes (HwB).—Huggins soils are 55 percent of this complex, Kadoka soils 30 percent, and other soils 15 percent. This complex is on uplands in areas of moderate size and irregular shape. Huggins soils are on the upper parts of slopes and on convex ridges. Kadoka soils are on the lower parts of slopes. These soils have a profile similar to that described as representative for their respective series.

Included with these soils in mapping are Goshen, Shena, and Wortman soils. Goshen soils are in swales, and Shena soils are on the tops of some of the ridges. Wortman soils are in some of the low areas and along the upper ends of drainages.

Surface runoff is medium. The Huggins part of the complex is somewhat droughty, and crop growth is uneven during dry periods.

Most areas are in native grass and are used for grazing. Winter wheat, spring-sown small grains, and alfalfa are the main crops in cultivated areas. Control of erosion, conservation of moisture, and the maintenance of tilth are the main concerns of management. Huggins: Clayey range site; capability unit IVe-3; pasture group E; windbreak group 4. Kadoka: Silty range site; capability unit IIe-1; pasture group F; windbreak group 3.

Kadoka Series

The Kadoka series consists of nearly level to strongly sloping, silty soils that are moderately deep over siltstone. These soils are on uplands. They formed in material weathered from the underlying siltstone.

In a representative profile the surface layer is grayish-brown silt loam about 4 inches thick. The subsoil is silty clay loam about 14 inches thick. It is grayish brown in the upper part, brown in the middle part, and light yellowish brown in the lower part. The underlying material is very pale brown, calcareous silt loam. Soft, very pale brown siltstone is at a depth of 38 inches.

Kadoka soils are well drained. Surface runoff is slow to medium and permeability is moderate. Available water capacity is moderate. The content of organic matter is moderate, and fertility is medium. Erosion is a hazard in sloping areas.

Less than half of the acreage is farmed. Winter wheat and alfalfa are the main crops. Many areas that were formerly farmed are now in native grass.

Representative profile of Kadoka silt loam, 0 to 2 percent slopes, in native grass; 2,240 feet east and 1,000 feet north of the SW. corner of sec. 29, T. 39 N., R. 31 W.:

A1—0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, platy structure that parts to moderate, medium and coarse, granular; soft, very friable; neutral; abrupt, smooth boundary.

B21t—4 to 10 inches, grayish-brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, prismatic structure that parts to moderate, medium and fine, subangular blocky; slightly hard, friable; thin, patchy, clay films on faces of peds; neutral; clear, smooth boundary.

B22t—10 to 15 inches, brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium and fine, blocky; hard, friable; thin continuous clay films on faces of peds; very fine siltstone fragments make up less than 5 percent, by volume; mildly alkaline; clear, wavy boundary.

B3—15 to 18 inches, light yellowish-brown (10YR 6/4) silty clay loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable; fine siltstone fragments make up 8 to 10 percent, by volume; mildly alkaline; abrupt, wavy boundary.

C1ca—18 to 38 inches, very pale brown (10YR 8/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard, very friable; calcareous; moderately alkaline; gradual, wavy boundary.

C2—38 to 60 inches, very pale brown (10YR 7/3) soft siltstone, brown (10YR 5/3) when moist; bedded; soft, very friable; siltstone fragments make up about 50 percent, by volume; calcareous; moderately alkaline.

The A horizon is silt loam or loam and ranges from 3 to 8 inches in thickness. The B horizon is silty clay loam or clay loam and ranges from 10 to 25 inches in thickness. Depth to lime is 12 to 33 inches. Small siltstone fragments are scattered throughout the profile. They commonly increase in number with depth.

Kadoka soils are mapped with or are near Epping, Huggins, Keith, Keota, Shena, and Tuthill soils. Kadoka soils are deeper over siltstone than Epping and Shena soils. They have a less clayey B horizon than Huggins soils. They differ from Keota soils in having a B horizon and in being deeper over lime. Unlike Keith soils, they have a siltstone C horizon at a depth of less than 40 inches. Kadoka soils are more silty than Tuthill soils.

Kadoka silt loam, 0 to 2 percent slopes (KaA).—This soil is on uplands in areas of moderate size. It has the profile described as representative for the series. Surface runoff is slow.

Included with this soil in mapping are Goshen, Huggins, and Keith soils. Goshen soils are in swales, and Huggins soils are on slight rises. Small areas of Keith soils are intermingled with Kadoka soils in the northwestern part of the county. These inclusions are about 15 percent of any mapped area of this soil.

Winter wheat, oats, and alfalfa are the main crops in cultivated areas. Conservation of moisture is the main concern of management. Control of soil blowing and maintenance of tilth, fertility and the content of organic matter are other concerns of management. Silty range site; capability unit IIc-2; pasture group F; windbreak group 3.

Kadoka-Epping silt loams, 5 to 9 percent slopes (KbC).—Kadoka soils are 55 percent of this complex, Epping soils 15 percent, Keota soils 15 percent, and other soils 15 percent. This complex is on uplands. The areas are fairly large and irregular in shape. Kadoka soils are on smooth side slopes and in saddles on the broader ridges. Keota and Epping soils are on the upper part of slopes and on ridges and knolls. These three soils have profiles similar to those described as representative for their respective series.

Included with these soils in mapping are Goshen, Huggins, and Wortman soils. Goshen soils are in swales. Huggins soils are on the upper part of some slopes. Wortman soils are in low areas along drainageways.

Surface runoff is medium to rapid. The Epping and Keota soils are high in lime and are low in fertility and the content of organic matter.

Most areas are in native grass and are used for grazing. Alfalfa and winter wheat are the main crops in cultivated areas. Epping soils are too shallow to siltstone for satisfactory cultivation. Control of erosion is the main concern of management. Improvement of fertility and the content of organic matter are other concerns of management. Kadoka: Silty range site; capability unit IIIe-1; pasture group F; windbreak group 3. Epping: Shallow range site; capability unit VIs-2; pasture group unassigned; windbreak group 10.

Kadoka-Huggins silt loams, 2 to 5 percent slopes (KdB).—Kadoka soils are 50 percent of this complex, Huggins soils 37 percent, and other soils 13 percent. These soils are closely intermingled in an erratic pattern. Kadoka and Huggins soils have a profile similar to that described as representative for their respective series.

Included with these soils in mapping are Goshen soils, which are in swales.

Surface runoff is medium. Huggins soils are low in available water capacity and are somewhat droughty.

Many areas are in native grass and are used for grazing. Winter wheat and alfalfa are the main crops in cultivated areas. Control of erosion is the main concern of management. Conservation of moisture and maintenance of the content of organic matter and fertility are other concerns of management. Kadoka: Silty range site; capability unit IIe-1; pasture group F; windbreak group 3. Huggins: Clayey range site; capability unit IIIe-12; pasture group E; windbreak group 4.

Kadoka-Huggins silt loams, 5 to 9 percent slopes (KdC).—Kadoka soils are 65 percent of this complex, Huggins soils 25 percent, and other soils 10 percent. This complex is on uplands. The areas are fairly large and irregular in shape. Surface drainage patterns are well defined. Kadoka soils are on the middle and lower parts of slopes. They have a profile similar to that described as representative for the Kadoka series, except that depth to lime is about 15 inches. Huggins soils are on the upper parts of slopes. They have a profile similar to that described as representative for the Huggins series, except that depth to siltstone is about 20 inches.

Included with these soils in mapping are Epping and Goshen soils. Epping soils are on ridgetops, and Goshen soils are in swales.

Surface runoff is medium. Huggins soils are low in available water capacity and are somewhat droughty.

Most areas are in native grass and are used for grazing. Alfalfa and winter wheat are the main crops in cultivated areas. Control of erosion and the conservation of moisture are the main concerns of management. Kadoka: Silty range site; capability unit IIIe-1; pasture group F; windbreak group 3. Huggins: Clayey range site; capability unit IVe-3; pasture group E; windbreak group 4.

Keith Series

The Keith series consists of deep, nearly level to strongly sloping, silty soils on uplands. These soils formed in silty loess.

In a representative profile (fig. 9) the surface layer is gray silt loam about 5 inches thick. The subsoil is about 21 inches thick. It is dark grayish-brown silty clay loam in the upper part and light-gray silt loam in the lower part. The upper part is very hard when dry and friable when moist. The underlying material is light-gray silt loam to a depth of 60 inches.

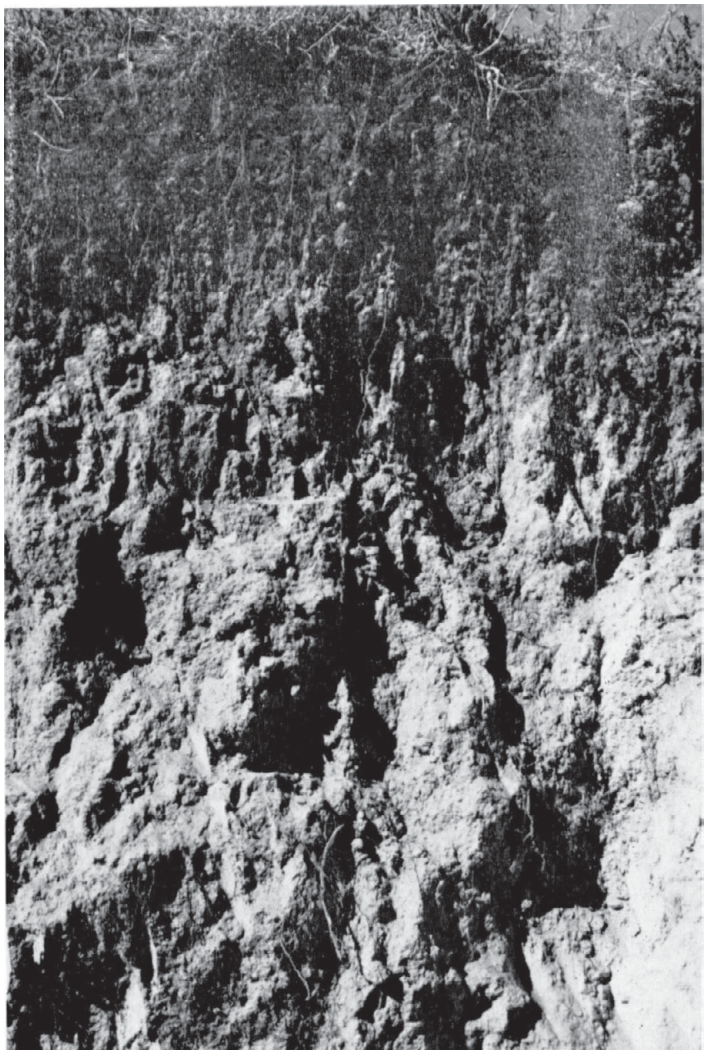


Figure 9.—**Profile of Keith silt loam, 0 to 2 percent slopes.**

Keith soils are well drained. Surface runoff is slow to medium, and permeability is moderate. Available water capacity is high. Fertility is medium, and the content of organic matter is moderate. Erosion is a hazard in sloping areas.

Many areas are cultivated. Winter wheat is the main crop, but these soils are well suited to all crops commonly grown in the county. Strongly sloping areas are mostly in native grass and are used for grazing.

Representative profile of Keith silt loam, 0 to 2 percent slopes; 800 feet north and 150 feet east of the SW. corner of sec. 10, T. 39 N., R. 32 W.:

Ap—0 to 5 inches, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) when moist; cloddy; soft, very friable; neutral; abrupt, smooth boundary.

B21t—5 to 10 inches, dark grayish-brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to mod-

erate, medium, blocky; thin patchy clay films; very hard, friable; mildly alkaline; clear, smooth boundary.

B22t—10 to 16 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, prismatic structure that parts to moderate, medium and fine, blocky; thin patchy clay films; hard, friable; mildly alkaline; clear, smooth boundary.

B3—16 to 26 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard, friable; moderately alkaline; clear, smooth boundary.

C1—26 to 37 inches, light-gray (10YR 7/2/) silt loam, dark brown (10YR 4/3) when moist; massive; soft, very friable; moderately alkaline; abrupt, smooth boundary.

C2ca—37 to 60 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) when moist; massive; soft, very friable; calcareous; strongly alkaline.

The A horizon ranges from dark grayish brown to gray in 10YR hue and from 5 to 8 inches in thickness. The prismatic structure of the B horizon ranges from weak to moderate in grade. In places the C horizon is underlain by very fine sand or bedded, soft siltstone at depths below 40 inches.

Keith soils are near Dawes, Goshen, Kadoka, and Richfield soils. Keith soils have less clay in the B horizon than Dawes and Richfield soils. They have thinner A and B horizons than Goshen soils. They are deeper over siltstone than Kadoka soils and, unlike Kadoka soils, they formed in silty loess.

Keith silt loam, 0 to 2 percent slopes (KeA).—This soil is on uplands. Slopes are long and smooth. This soil has the profile described as representative for the series. Surface runoff is slow, and available water capacity is high.

Included with this soil in mapping are Dawes, Goshen, and Kadoka soils. Dawes and Goshen soils are in swales and in flat low areas. Kadoka soils are on slight rises. These inclusions are less than 10 percent of any mapped area of this soil.

Most areas are cultivated. Winter wheat and alfalfa are the main crops. Conservation of moisture is the main concern of management. Control of soil blowing and the maintenance of tilth, fertility, and the content of organic matter are other concerns of management. Silty range site; capability unit IIc-2; pasture group F; windbreak group 3.

Keith silt loam, 2 to 9 percent slopes (KeC).—This soil is on uplands. Slopes are long and smooth, except on some of the steeper parts of the large, irregular areas. Surface runoff is medium.

Included with this soil in mapping are Epping, Goshen, and Kadoka soils. Epping soils are on some of the ridges and knolls and on the shoulders of some drainageways. Goshen soils are in swales. Kadoka soils are on the upper part of some of the steeper slopes. These inclusions are as much as 40 percent of some mapped areas of this soil.

Many areas are in native grass and are used for grazing. Winter wheat and alfalfa are the main crops in cultivated areas. Control of erosion is the main concern of management. Maintenance of tilth, fertility, and content of organic matter are other concerns of management. Silty range site; capability unit IIIe-1; pasture group F; windbreak group 3.

Keith-Epping silt loams, 9 to 15 percent slopes (KgD).—Keith soils are 45 percent of this complex, Epping soils 30 percent, and other soils 25 percent. This complex is on uplands. The areas are large and irregular in shape. Keith soils have long, smooth slopes. Lime is at a depth of about 25 inches and the subsoil is thinner than that in the profile described as representative for the Keith series. Epping soils are on ridgetops and on shoulders of draws. They have a profile similar to that described as representative for the Epping series. Surface runoff on the soils of this complex is medium to rapid.

Included with these soils in mapping are Goshen, Kadoka, and Keota soils. Goshen soils are in swales. Kadoka and Keota soils are on the convex upper slopes. Siltstone crops out in some areas. These areas are shown on the soil map by the symbol for rock outcrops.

Nearly all areas are in native grass and are used for grazing. Winter wheat is the main crop in cultivated areas. Control of erosion is the main concern of management. Maintenance of the content of organic matter and fertility are also concerns of management. Keith: Silty range site; capability unit IVe-1; pasture group F; windbreak group 3. Epping: Shallow range site; capability unit VIs-2; pasture group unassigned; windbreak group 10.

Keota Series

The Keota series consists of strongly sloping to steep, calcareous, silty soils that are moderately deep over siltstone. These soils are on uplands. They formed in silty material weathered from the underlying siltstone.

In a representative profile the surface layer is light brownish-gray silt loam about 5 inches thick. Below this layer is a transitional layer of pale-brown and light-gray silt loam about 16 inches thick. It is soft to slightly hard when dry and friable when moist. The underlying material is light-gray silt loam. White loam and siltstone are at a depth of 31 inches.

Keota soils are well drained. Surface runoff is rapid, and permeability is moderate. Available water capacity is low to moderate. Fertility and the content of organic matter are low. Erosion is a severe hazard.

Nearly all areas are in native grass and are used for grazing. Only a few scattered areas mapped with Kadoka soils are in cultivation.

Representative profile of Keota silt loam from an area of Keota-Epping silt loams, 9 to 21 percent slopes; 2,340 feet west and 100 feet south of the NE. corner of sec. 32, T. 39 N., R. 30 W.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, granular structure; soft, very friable; calcareous; strongly alkaline; clear, smooth boundary.

AC1—5 to 13 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky and granular structure; soft, friable; calcareous; strongly alkaline; clear, smooth boundary.

AC2—13 to 21 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable; calcareous; strongly alkaline; clear, smooth boundary.

C1—21 to 31 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) when moist; massive; slightly hard, friable; calcareous; strongly alkaline; clear, wavy boundary.

C2—31 to 60 inches, white (10YR 8/2) soft siltstone, brown (10YR 5/3) and yellowish brown (10YR 5/4) when moist; bedded; calcareous; strongly alkaline.

The A horizon is grayish-brown or light brownish-gray silt loam or silty clay loam. It ranges in thickness from 3 to 6

inches. A few fine siltstone fragments are scattered throughout the profile. Depth to siltstone is 20 to 40 inches. Buried dark-colored layers are in the profile in places.

Keota soils are mapped with Epping and Kadoka soils. Keota soils are deeper over siltstone than Epping soils. They contain less clay than Kadoka soils, and they do not have a Bt horizon that is typical of Kadoka soils.

Keota-Epping silt loams, 9 to 21 percent slopes (KhE).—Keota soils are 40 percent of this complex, Epping soils 35 percent, and other soils 25 percent. Many of the areas are north of U.S. Highway No. 18 and consist of deeply incised draws that drain to the Little White River. Keota soils are on the long side slopes. Epping soils are on the upper part of slopes, on ridgetops, and on shoulders of draws. Slopes of the Epping soils generally are short and have a step-and-riser appearance. The Keota soils and the Epping soils in this complex have the profile described as representative for their respective series.

Included with these soils in mapping are areas of Goshen, Kadoka, and Wortman soils. Goshen soils are in swales. Kadoka soils are on some of the more gently sloping areas. Wortman soils are on foot slopes.

Surface runoff is rapid. The content of lime is high. Fertility and the content of organic matter are low. Erosion is a severe hazard. Available water capacity is very low in Epping soils, and they are droughty.

All areas are in native grass and are used for grazing. Keota: Thin Upland range site; capability unit VIe-3; pasture group unassigned; windbreak group 10. Epping: Shallow range site; capability unit VIs-2; pasture group unassigned; windbreak group 10.

Keota-Kadoka silt loams, 9 to 15 percent slopes (KkD).—Keota soils are 45 percent of this complex, Kadoka soils 40 percent, and other soils 15 percent. Some of the areas are large and irregular in shape, and others are long and narrow. Keota soils are on the upper part of convex slopes, ridgetops, and on shoulders of draws. They have a profile similar to that described as representative for the Keota series. Kadoka soils are on the smoother, lower part of slopes. Their subsoil is thinner, and depth to lime is less than that in the profile described as representative for the Kadoka series.

Included with these soils in mapping are Epping, Goshen, and Wortman soils. Epping soils are on some of the ridges. Goshen and Wortman soils are in swales and on foot slopes.

Surface runoff is medium to rapid. Keota soils are high in lime and low in fertility and content of organic matter.

Nearly all areas are in native grass and are used for grazing. Control of erosion is the main concern of management. Keota: Thin Upland range site; capability unit VIe-3; pasture group F; windbreak group 10. Kadoka: Silty range site; capability unit IVe-1; pasture group F; windbreak group 3.

Keota-Rock outcrop complex, 16 to 40 percent slopes (KrF).—Keota soils are 30 to 40 percent of this complex, Epping soils 30 percent, Rock outcrop 15 to 25 percent, and other soils 15 percent. The areas are along the Little White River in the vicinity of Ghost Hawk Park and extend several miles back from the river and downstream to the northern boundary of the county. Slopes generally are about 20 percent, but the areas of Rock outcrop are steeper and include almost vertical walls. In places the areas have a "badland" appearance. Keota soils are on the steep side slopes. Epping soils and Rock outcrop are on the ridges and steep rims of the draws. The Keota and the Epping soils have a profile similar to that described as representative for their respective series. The areas of Rock outcrop are siltstone that is pink or buff when dry. Surface runoff on the soils of this complex is rapid to very rapid.

Included with this complex in mapping are areas of Goshen and Kadoka soils. Goshen soils are in swales. Kadoka soils are on the more gentle and smoother side slopes and on flattened ridgetops.

All areas are in native grass and are used for grazing. Ponderosa pine and bur oak grow in scattered areas. In places the growth is relatively dense. Control of erosion is the main concern of management. Keota: Thin Upland range site; capability unit VIIe-3; pasture group unassigned; windbreak group 10. Rock outcrop: capability unit VIIIs-1; range site, pasture group, and windbreak group unassigned.

Keya Series

The Keya series consists of deep, nearly level, silty soils on flats and in swales. These soils formed in loamy alluvium washed in from adjacent soils. They are on uplands.

In a representative profile the surface layer is silt loam about 19 inches thick. It is dark gray in the upper part and dark grayish brown in the lower part. The subsoil is about 25 inches thick. It is dark grayish-brown and grayish-brown clay loam in the upper part and light brownish-gray loam in the lower part. It is hard when dry and firm when moist. The underlying material is light brownish-gray fine sandy loam to a depth of 60 inches.

Keya soils are moderately well drained to well drained. Surface runoff is slow, and permeability is moderate. Most areas receive runoff water from adjacent soils. Available water capacity is high. Fertility and the content of organic matter are high.

These soils are used for crops, hay, and grazing. They are suited to all crops commonly grown in the county. In many places their use is dependent on the use of adjacent soils.

Representative profile of Keya silt loam; 2,390 feet east and 250 feet south of the NW. corner of sec. 5, T. 37 N., R. 26 W.:

Ap—0 to 5 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; cloddy; slightly hard, friable; neutral; abrupt, smooth boundary.

A12—5 to 19 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts readily to moderate, medium and fine, granular; slightly hard, friable; neutral; clear, wavy boundary.

B21t—19 to 28 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; faces of peds coated very dark brown (10YR 2/2) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm; thin continuous clay films; mildly alkaline; gradual, wavy boundary.

B22t—28 to 38 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; faces of peds coated very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, blocky; hard, firm; thin

continuous clay films on vertical faces of peds; mildly alkaline; clear, wavy boundary.

B3—38 to 44 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic and blocky structure; slightly hard, friable; mildly alkaline; clear, smooth boundary.

C—44 to 60 inches, light brownish-gray (10YR 6/2) heavy fine sandy loam, grayish brown (10YR 5/2) when moist; single grain; loose; mildly alkaline.

The A horizon is silt loam or loam and ranges from 14 to 24 inches in thickness. The B horizon is sandy clay loam to silty clay loam. Combined thickness of the A and B horizons is 28 to 60 inches. In places soft sandstone is between depths of 40 and 60 inches.

Keya soils are near Tuthill soils, and they are in swales near Goshen and Vetal soils. Keya soils have a thicker A horizon than Tuthill soils, are less silty than Goshen soils, and contain more clay and less sand than Vetal soils.

Keya silt loam (0 to 2 percent slopes) (Ky).—This is the only Keya soil mapped in the county. It is in swales and along drainageways. The areas are long and narrow.

Included with this soil in mapping are areas of Kadoka, Richfield, and Tuthill soils. These inclusions are on the outer edges of the mapped areas.

Surface runoff is slow, and the soil receives moisture in the form of runoff from adjacent soils. The additional moisture is beneficial in most years. Wetness is a hazard only in years of above average precipitation.

Many areas are cultivated, and the soil is suited to all crops grown in the county. Conservation of moisture is the main concern of management. Maintenance of tilth and fertility are other concerns of management. Overflow range site; capability unit IIc-3; pasture group K; windbreak group 1.

Loamy Alluvial Land

Loamy alluvial land (0 to 2 percent slopes) (la) consists of mixed soils that formed in alluvium. It is on bottom lands. The areas are long and narrow. They are 400 to 700 feet in width and are dissected by well-defined channels that meander through the areas. The channels are from 3 to 10 feet in depth and from 6 to 15 feet in width.

The surface layer in most areas is silt loam or loam and is underlain by stratified alluvial material ranging from loamy sand to silty clay loam in texture. In places the surface layer in areas adjacent to the channel is loamy sand. In the northeastern part of the county these soils are more clayey than in other areas.

Flooding is a hazard during snow melt periods in spring and after heavy rains in summer. Debris and fresh sediment are deposited after each flooding.

This land type is not suited to cultivation. Most areas are in native vegetation and are used for grazing. Scattered clumps and stands of native trees provide excellent shelter for livestock and for wildlife. Overflow range site; capability unit VIw-3; pasture group unassigned; windbreak group 10.

Loup Series

The Loup series consists of deep, nearly level, sandy soils that have a water table. These soils formed in alluvium on bottom lands and valley floors in and near the Sandhills.

In a representative profile the surface layer is about 4 inches thick. It is very dark gray loamy fine sand in the upper part and dark-gray sandy loam in the lower part. Below this layer is a transitional layer of gray, loose, loamy sand and loamy fine sand about 11 inches thick. The underlying material is light-gray fine sand to a depth of 60 inches.

Loup soils are poorly drained to very poorly drained. Surface runoff is very slow, and permeability is rapid. The water table is near the surface early in the growing season, but it recedes to a depth of about 3 feet late in summer. Available water capacity is low. Fertility is medium, and the content of organic matter is high.

All the areas are used for hay or for grazing. The native vegetation consists mainly of tall grasses and sedges, but some trees are along the streams. In some areas bluegrass and red clover have been introduced and are a part of the plant community.

Representative profile of Loup loamy fine sand from an area of Loup-Elsmere loamy fine sands; 2,300 feet east and 75 feet south of the NW. corner of sec. 9, T. 35 N., R. 32 W.:

O1—½ inch to 0, very dark grayish-brown (10YR 3/2) decomposed plant remains, very dark brown (10YR 2/2) when moist; fibrous; neutral; abrupt, smooth boundary.

A11—0 to 2 inches, very dark gray (10YR 3/1) loamy fine sand, black (10YR 2/1) when moist; weak, medium, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

A12—2 to 4 inches, dark-gray (10YR 4/1) sandy loam, black (10YR 2/1) when moist; weak, medium, granular structure; soft, very friable; neutral; clear, smooth boundary.

AC1—4 to 8 inches, gray (10YR 5/1) loamy sand, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure that parts to single grain; loose; mildly alkaline; clear, smooth boundary.

AC2—8 to 15 inches, gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) when moist; single grain; loose; mildly alkaline; clear, smooth boundary.

C—15 to 60 inches, light-gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) when moist; single grain; loose; neutral.

The O horizon is absent in some profiles. The A horizon ranges from sandy loam to loamy fine sand. The entire profile commonly is stratified with layers of material that is finer textured and coarser than fine sand. Mottles that disappear upon exposure to air commonly are throughout the profile.

Loup soils are near Elsmere and Gannett soils. They are more poorly drained than Elsmere soils. They are better drained and have a thinner O horizon than Gannett soils. Loup soils are more poorly drained and are more sandy than Wann soils, which also formed in alluvium.

Loup-Elsmere loamy fine sands (0 to 2 percent slopes) (le).—Loup soils are 60 percent of this complex, Elsmere soils 25 percent, and other soils 15 percent. This complex is in areas that are long and narrow. It is on bottom lands in the Sandhills and along drainageways in areas adjacent to the Sandhills. In places small flowing streams meander through the areas. Slight rises or undulations commonly break the nearly level relief. Loup soils are on the more level areas. They have the profile described as representative for the Loup series. Elsmere soils are on the undulations. They have a profile similar to that described as representative for the Elsmere series.

Included with these soils in mapping are areas of Doger and Gannett soils. Doger soils are on the higher

undulations and on the outer edges of some areas. Gannett soils are in low areas.

Surface runoff is slow to very slow. The high water table in Loup soils makes them too wet for cultivation.

Most areas are in native grass and are used for hay or for grazing. The soils in this complex are well suited to hay meadows. Loup: Subirrigated range site; capability unit Vw-3; pasture group B; windbreak group 10. Elsmere: Subirrigated range site; capability unit IVe-10; pasture group A; windbreak group 2.

Millboro Series

The Millboro series consists of deep, nearly level to sloping, clayey soils on uplands. These soils formed in thick deposits of clayey material overlying soft shale. Slopes commonly are long and smooth.

In a representative profile the surface layer is very dark grayish-brown silty clay about 5 inches thick. The subsoil is about 27 inches thick. It is clay that is dark grayish brown in the upper part, grayish brown in the middle part, and light brownish gray in the lower part. It is very hard when dry and very firm when moist. The underlying material is calcareous, light olive-gray clay and silty clay to a depth on 60 inches.

Millboro soils are well drained. Surface runoff is medium, and permeability is slow. Available water capacity is moderate to low. Fertility is medium, and the content of organic matter is moderate. Tilth deteriorates quickly if these soils are cultivated. Soil blowing and water erosion are hazards.

Many areas are in native grass and are used for grazing and for hay. Other areas are cultivated. Winter wheat, oats, sorghum, alfalfa, and tame grasses are the main crops.

Representative profile of Millboro silty clay, 2 to 5 percent slopes; 600 feet east and 700 feet north of the SW. corner of sec. 7, T. 39 N., R. 25 W.:

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; hard, friable; mildly alkaline; clear, smooth boundary.

B21t—5 to 8 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, blocky; very hard, very firm; mildly alkaline; abrupt, wavy boundary.

B22t—8 to 17 inches, grayish-brown (2.5Y 5/2) clay, dark grayish-brown (2.5Y 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, blocky; very hard, very firm; mildly alkaline; abrupt, wavy boundary.

B23t—17 to 23 inches, grayish-brown (2.5Y 5/2) clay, dark grayish-brown (2.5Y 4/2) when moist; moderate, medium, blocky structure; very hard, very firm; calcareous; moderately alkaline; clear, wavy boundary.

B3ca—23 to 32 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) when moist; weak, medium, blocky structure; very hard, very firm; common medium lime segregations; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—32 to 38 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) when moist; massive; hard, firm; common medium segregations of lime; calcareous; moderately alkaline; clear, smooth boundary.

C2—38 to 60 inches, light olive-gray (5Y 6/2) silty clay, olive gray (5Y 5/2) when moist; massive; hard, firm; calcareous; moderately alkaline.

The A horizon ranges from very dark grayish brown to grayish brown. It is silty clay or silty clay loam and is from 4 to 7 inches in thickness. In places the A horizon is moderately alkaline. The B horizon is from 17 to 30 inches in thickness. The C horizon is silty clay loam to clay. Depth to bedded shale ranges from 40 to more than 60 inches. Salt crystals commonly are visible in the C horizon above the bedded shale.

Millboro soils are near Boyd, Hoven, and Samsil soils. Millboro soils are deeper over shale than Boyd and Samsil soils. Unlike Hoven soils, they do not have an A2 horizon, and they are better drained than those soils.

Millboro silty clay, 0 to 2 percent slopes (MbA).—This soil is in areas that are fairly large and irregular in shape. Slopes are long and uniform.

Included with this soil in mapping are Hoven soils. Hoven soils are in small depressions less than 2 acres in size. Their location in the mapped areas of this soil is shown on the detailed map by the symbol for wet spot. Surface runoff is medium, and permeability is slow.

Many areas of this soil are cultivated. Winter wheat, oats, sorghum, and alfalfa are the main crops. Maintenance of tilth, fertility, and the content of organic matter are the main concerns of management. Control of soil blowing is also a concern of management. Clayey range site; capability unit IIIs-3; pasture group I; windbreak group 4.

Millboro silty clay, 2 to 5 percent slopes (MbB).—This soil has the profile described as representative for the series. It is in areas that are large and irregular in shape. Slopes are long and smooth. Surface runoff is medium, and permeability is slow.

Included with this soil in mapping are narrow strips of Hoven soils along some of the drainageways. These inclusions are less than 5 percent of any mapped area of this soil.

About half of the acreage of this soil is cultivated. Winter wheat, oats, sorghum, and alfalfa are the main crops. Control of erosion is the main concern of management. Maintenance of tilth, fertility, and content of organic matter are also concerns of management. Clayey range site; capability unit IIIe-4; pasture group I; windbreak group 4.

Millboro silty clay, 5 to 9 percent slopes (MbC).—This soil is in areas that are large and irregular in shape. Slopes are long and uniform. The surface layer is slightly thinner than that in the profile described as representative for the series. In places the surface has an uneven relief in the form of ridges and troughs that extend up and down the slope. Lime is at a depth of 12 inches. Surface runoff is medium, and permeability is slow.

Included with this soil in mapping are Boyd soils on ridgetops. Small areas of gravel are on some of the highest ridges, and they are shown on the detailed map by the symbol for gravel. These inclusions are less than 10 percent of any mapped area of this soil.

Many areas of this soil are in native grass and are used for grazing. Winter wheat is the main crop in cultivated areas. Control of erosion is the main concern of management. Clayey range site; capability unit IVe-4; pasture group I; windbreak group 4.

Minatare Series

The Minatare series consists of deep, nearly level to gently undulating, silty soils that have a claypan subsoil.

These soils formed in alluvium and are on terraces and foot slopes along streams and their tributaries.

In a representative profile the surface layer is dark-gray silt loam about 1 inch thick. The subsurface layer is light-gray silt loam about 2 inches thick. The subsoil is clay and is about 8 inches thick. It is dark gray in the upper part, dark grayish brown in the middle part, and light brownish gray in the lower part. The underlying material is light-gray, calcareous silty clay loam to a depth of 33 inches and very pale brown, calcareous very fine sandy loam to a depth of 60 inches.

Minatare soils are somewhat poorly drained. Surface runoff and permeability are very slow. Available water capacity is moderate to high, but the claypan subsoil releases moisture slowly to plants. Fertility is low and the content of organic matter is moderately low.

Minatare soils in Todd County are mapped only with Mosher soils.

Almost all areas are in native grass and are used for grazing. The native vegetation consists of short grasses, mid grasses, and annuals.

Representative profile of Minatare silt loam from an area of Mosher-Minatare silt loams, 0 to 4 percent slopes; 1,320 feet south and 300 feet east of the NW. corner of sec. 10, T. 38 N., R. 27 W.:

A1—0 to 1 inch, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

A2—1 to 3 inches, light-gray (10YR 7/2) silt loam, gray (10YR 5/1) when moist; weak, fine, platy structure; soft, very friable; neutral; abrupt, smooth boundary.

B21t—3 to 6 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, medium and fine, columnar structure that parts to strong, medium and fine, blocky; extremely hard, extremely firm; thin continuous clay films; moderately alkaline; abrupt, smooth boundary.

B22t—6 to 8 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, blocky; extremely hard, extremely firm; thin continuous clay films; calcareous; strongly alkaline; clear, smooth boundary.

B3ca—8 to 11 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure; very hard, very firm; calcareous; strongly alkaline; clear, smooth boundary.

C1—11 to 33 inches, light-gray (10YR 7/2) silty clay loam, light brownish gray (10YR 6/2) when moist; massive; hard, firm; calcareous; strongly alkaline; gradual, smooth boundary.

C2—33 to 60 inches, very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) when moist; massive; slightly hard, friable; calcareous; moderately alkaline.

The A horizon is silt loam or loam and is from ½ to 4 inches in thickness. The A1 horizon is absent in places.

The solum ranges from 8 to 15 inches in thickness. The C horizon commonly has stratified layers of finer and coarser textured material.

Minatare soils have a thinner A horizon than the Mosher soils with which they are mapped. Unlike Wanblee soils, which have a similar profile, Minatare soils do not have silt stone in the C horizon.

Mosher Series

The Mosher series consists of deep, nearly level to gently sloping, silty soils that have a claypan subsoil.

465-344—74——3

These soils formed in alluvium and are on terraces and foot slopes along streams and their tributaries.

In a representative profile the surface layer is dark-gray silt loam about 6 inches thick. The subsurface layer is gray loam about 1 inch thick. The subsoil is clay loam about 10 inches thick. It is dark gray in the upper part and gray in the lower part. It is extremely hard when dry and firm when moist. The underlying material is stratified clay loam, fine sand, and fine gravel.

Mosher soils are moderately well drained. Surface runoff is slow, and permeability is very slow. Most areas receive some runoff water from adjacent soils. Available water capacity is moderate to high. Fertility is low, and content of organic matter is moderate.

Most areas are in native grass and are used for grazing. A few areas are cultivated. Small grains and alfalfa are the main crops.

Representative profile of Mosher silt loam, 0 to 4 percent slopes; 800 feet east and 200 feet north of the SW. corner of sec. 36, T. 38 N., R. 26 W.:

A1—0 to 6 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure; soft, friable; neutral; gradual, smooth boundary.

A2—6 to 7 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure; soft, friable; neutral; abrupt, smooth boundary.

B21t—7 to 14 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, columnar structure that parts to strong, fine, blocky; extremely hard, firm; thin continuous clay films; moderately alkaline; gradual, wavy boundary.

B22t—14 to 17 inches, gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to strong, fine, blocky; extremely hard, firm; thin continuous clay films; moderately alkaline; clear, smooth boundary.

C1ca—17 to 20 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, firm; thin patchy clay films; calcareous; moderately alkaline; clear, smooth boundary.

C2—20 to 28 inches, light brownish-gray (10YR 6/2) stratified clay loam, fine sand, and fine gravel, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable; calcareous; moderately alkaline; gradual, smooth boundary.

C3—28 to 60 inches, light-gray (10YR 7/2) stratified clay loam, fine sand, and fine gravel, light brownish gray (10YR 6/2) when moist; massive; slightly hard to loose, very friable; calcareous; moderately alkaline.

The A horizon is loam or silt loam and ranges from 5 to 11 inches in thickness. Nests of salt crystals commonly are in the lower part of the B horizon and in the C horizon. The C horizon ranges from fine sandy loam to clay loam, and it commonly has stratified layers of coarser textured material. In places sandstone or siltstone is at a depth of 40 to 60 inches.

Mosher soils have a thicker A horizon than the Minatare soils with which they are mapped. Unlike Wortman soils, which have a similar profile, Mosher soils do not have siltstone at a moderate depth in the C horizon. They have a more clayey B horizon than the nearby Whitelake soils.

Mosher silt loam, 0 to 4 percent slopes (MhA).—This soil has the profile described as representative for the series. It is on terraces and on foot slopes along some of the larger streams. The areas are long and narrow. In places mounds and small depressions make the surface uneven.

Included with this soil in some mapped areas are Minatare soils. They are in the low spots and make up as much as 20 percent of some mapped areas.

Surface runoff is slow, and permeability is very slow. The dense claypan subsoil makes this soil droughty.

Many areas are in native grass and are used for grazing. Alfalfa and small grains are the main crops in cultivated areas. Improvement of tilth and fertility are among the concerns of management. Claypan range site; capability unit IVs-2; pasture group C; windbreak group 9.

Mosher-Minatare silt loams, 0 to 4 percent slopes (MmA).—Mosher soils are 60 percent of this complex and Minatare soils 40 percent. Slopes are nearly level in the areas on terraces, but they are as much as 4 percent on the adjacent foot slopes. Mounds and depressions that range from two to several feet in diameter make the surface uneven. Mosher soils are on the mounds and have a profile similar to that described as representative for the Mosher series. Minatare soils are in the low spots or small depressions. They have the profile described as representative for the Minatare series.

Surface runoff is slow to very slow, and water penetrates the soil very slowly. The dense claypan subsoil gives up moisture slowly to plants, and these soils are droughty in midsummer and late in summer.

Most areas are in native grass and are used for grazing. Mosher: Claypan range site; capability unit IVs-2; pasture group C; windbreak group 9. Minatare: Thin Claypan range site; capability unit VIs-1; pasture group unassigned; windbreak group 10.

Okreek Series

The Okreek series consists of sloping to moderately steep, clayey soils that are moderately deep over shale. They are on uplands. These soils formed in material weathered from the underlying soft shale.

In a representative profile the surface layer is very dark gray silty clay about 5 inches thick. The subsoil is about 25 inches thick. It is clay that is dark gray in the upper part, light brownish gray in the middle part, and light olive gray in the lower part. It is very hard to extremely hard when dry and very firm to extremely firm when moist. The middle and lower parts are calcareous. The underlying material is light olive-gray, calcareous clay. Light olive-gray, soft clay shale is at a depth of 38 inches.

Okreek soils are well drained. Surface runoff is medium, and permeability is slow. Available water capacity is low. Fertility is medium, and content of organic matter is moderate. Tilth deteriorates quickly if these soils are cultivated. Erosion is a hazard.

Nearly all areas are in native grass and are used for grazing. Winter wheat and alfalfa are the main crops in cultivated areas.

Representative profile of Okreek silty clay, 5 to 9 percent slopes; 900 feet west and 200 feet north of the SE. corner of sec. 10. T. 39 N., R. 26 W.:

A1—0 to 5 inches, very dark gray (10 YR 3/1) silty clay, very dark brown (10YR 2/2) when moist; moderate, medium and fine, granular structure; hard, friable; neutral; clear, smooth boundary.

B21t—5 to 10 inches, dark-gray (10YR 4/1) clay, very dark brown (10YR 2/2) when moist; moderate, medium, prismatic structure that parts easily to strong, fine and medium, subangular blocky; very hard, very firm; thin continuous clay films; mildly alkaline; clear, smooth boundary.

B22t—10 to 16 inches, dark-gray (10YR 4/1) clay, very dark brown (10YR 2/2) when moist; moderate, medium, prismatic structure that parts to strong, medium and fine, subangular blocky and blocky; very hard, very firm; thin, continuous clay films; mildly alkaline; abrupt, smooth boundary.

B23t—16 to 22 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) when moist; strong, coarse, prismatic structure that parts to moderate, medium and coarse, blocky; calcareous; moderately alkaline; clear, smooth boundary.

B3ca—22 to 30 inches, light olive-gray (5Y 6/2) clay, grayish brown (2.5Y 5/2) when moist; strong, coarse, prismatic structure that parts to weak, coarse, blocky; extremely hard, extremely firm; common, medium, prominent segregations of lime; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—30 to 38 inches, light olive-gray (5Y 6/2) clay, light brownish gray (2.5Y 6/2) when moist; massive; extremely hard, extremely firm; common, medium, prominent segregations of lime; calcareous; moderately alkaline; clear, smooth boundary.

C2—38 to 60 inches, light olive-gray (5Y 6/2) clay shale, olive gray (5Y 5/2) when moist; bedded, platy; extremely hard, extremely firm; calcareous; moderately alkaline.

The A horizon is very gray or dark gray of 10YR hue. It is silty clay loam or light silty clay. Depth to soft shale is 30 to 40 inches.

Okreek soils are deeper over shale than the nearby Orella soils. They are not so deep over shale as Millboro soils, which have a similar profile.

Okreek silty clay, 5 to 9 percent slopes (OkC).—This soil has the profile described as representative for the series. It is on uplands in areas that are large and irregular in shape. Slopes commonly are long and smooth, but along drainageways they are short and convex. Surface runoff is medium, and permeability is slow.

Included with this soil in mapping are Boyd and Orella soils. Boyd soils are at lower elevations. Orella soils are on ridgetops and on shoulders of drainageways. These inclusions are about 10 percent of any mapped area of this soil.

Most areas are in native grass and are used for grazing. Winter wheat and alfalfa are the main crops in cultivated areas. Control of erosion is the main concern of management. Maintenance of tilth, fertility, and content of organic matter are also concerns of management. Clayey range site; capability unit IVe-4; pasture group I; windbreak group 4.

Okreek-Orella complex, 6 to 21 percent slopes (OoE).—Okreek soils make up 60 percent of this complex, Orella soils 30 percent, and other soils 10 percent. This complex is on uplands. Okreek soils are on the side slopes. Lime is at a depth of 10 inches. Depth to soft shale is less than that in the profile described as representative for the Okreek series. In places the surface layer is silty clay loam. Orella soils are on the steeper upper slopes and on shoulders of draws. They have the profile described as representative for the Orella series. Surface runoff is medium to rapid.

Included with these soils in mapping are Hoven, Millboro, and Samsil soils. Hoven soils are along some of the drainageways. Millboro soils are on some of the lower and more gentle slopes. Samsil soils are on the shoulders of some of the draws.

The soils in this complex are not suitable for cultivation. Nearly all areas are in native grass and are used for grazing. Control of erosion is the main concern of management. Okreek: Clayey range site; capability unit

VIe-4; pasture group I; windbreak group 10. Orella: Shallow range site; capability unit VIs-3; pasture group unassigned; windbreak group 10.

Orella Series

The Orella series consists of sloping to steep, clayey soils that are shallow over shale. These soils are on uplands. They formed in material weathered from the underlying shale.

In a representative profile the surface layer is dark grayish-brown silty clay about 3 inches thick. Below this layer is a transitional layer of grayish-brown clay about 7 inches thick. It is very hard when dry and very firm when moist. Bedded, calcareous, white soft shale is at a depth of 10 inches.

Orella soils are well drained. Surface runoff is rapid, and permeability is very slow. Available water capacity is very low. Fertility and the content of organic matter are low. Erosion is a hazard.

The areas of these soils are in native grass and are used for grazing. These soils are not suited to cultivated crops.

Representative profile of Orella silty clay from an area of Okreek-Orella complex, 6 to 21 percent slopes; 2,565 feet west and 50 feet south of the NE. corner of sec. 31, T. 39 N., R. 25 W.:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure that parts to strong, fine, granular; slightly hard, friable; mildly alkaline; clear, smooth boundary.

AC1—3 to 7 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; weak, fine, blocky and subangular blocky structure; very hard, very firm; mildly alkaline; clear, wavy boundary.

AC2—7 to 10 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; weak, medium, blocky structure; very hard, very firm; moderately alkaline; abrupt, wavy boundary.

C—10 to 60 inches, white (2.5Y 8/2) soft shale, light brownish gray (2.5Y 6/2) when moist; mottled with coarse, yellowish-brown splotches and bands; bedded; very hard, firm; calcareous; moderately alkaline.

The A horizon ranges from 3 to 5 inches in thickness. Depth to shale ranges from 8 to 15 inches. The shale commonly is platy.

Orella soils are mapped with Okreek soils and are near Canyon, Epping, and Samsil soils. Orella soils are shallower to bedded soft shale or clay than Okreek soils and are more clayey than Canyon and Epping soils. They contain more sodium than Samsil soils.

Orella-Rock outcrop complex, 15 to 40 percent slopes (OrF).—Orella soils make up 40 percent of this complex, Rock outcrop 25 percent, and other soils 35 percent. This complex is in long, narrow areas on the sides of buttes. Slopes are short, but the difference in elevation ranges from 150 to 200 feet. Orella soils are below the ledges of Rock outcrop. They have a profile similar to that described as representative for the series. Rock outcrop consists of ledges of light-gray siltstone and mudstone on the higher parts of the complex.

Included with these soils in mapping are areas of Boyd, Huggins, and Okreek soils. Okreek soils are the most extensive of these inclusions and are on the lower slopes and less steep side slopes. Boyd soils are on some of the foot slopes and in swales. Huggins soils are on the tops of the ridges and buttes above the Rock outcrop.

Surface runoff is rapid. Orella soils have very low available water capacity. They are too shallow and too steep for cultivation.

All areas are in native vegetation and are used for grazing. Scattered clumps of bur oak and ash in some of the deeper draws provide shelter for livestock and wildlife. Control of erosion is the main concern of management. Orella: Shallow range site; capability unit VIIs-2; pasture group unassigned; windbreak group 10. Rock outcrop: capability unit VIIIs-1; range site, pasture group, and windbreak group unassigned.

Peaty Muck

Peaty muck (Pm) consists of layers of peat in broad, almost flat basins within the Sandhills. The peat ranges from 3 to more than 10 feet in thickness and contains lenses of sand ranging from 1 to 4 inches in thickness. The upper 2 feet are well decomposed, but plant remains are recognizable below that depth.

Included with Peaty muck in mapping are Gannett soils on the outer edges of the mapped areas at slightly higher levels. Marshy spots are in the lowest parts of the areas. These inclusions are about 20 percent of any mapped area of Peaty muck.

Areas of Peaty muck are too wet for cultivation and are used for hay and for grazing. The peat burns readily if fires are started in these areas. Wetland range site; capability unit Vw-3; pasture group unassigned; windbreak group 10.

Richfield Series

The Richfield series consists of deep, nearly level to strongly sloping, silty soils that formed in loess. These soils are on uplands.

In a representative profile (fig. 10) the surface layer is dark-gray silt loam about 9 inches thick. The subsoil is about 21 inches thick. It is silty clay loam that is dark grayish brown in the upper part and grayish brown in the lower part. It is hard when dry and firm when moist. The underlying material is light-gray silt loam to a depth of 50 inches, where it changes abruptly to calcareous, weakly cemented sandstone.

Richfield soils are well drained. Surface runoff is slow to medium, and permeability is moderately slow. Available water capacity is moderate to high. Fertility is medium, and the content of organic matter is moderate. Erosion is a hazard in sloping areas.

These soils are well suited to cultivation, but less than half of the acreage is farmed. Winter wheat and alfalfa are the main crops. Many areas are in native grass and are used for grazing.

Representative profile of Richfield silt loam from an area of Richfield-Dawes silt loams, 0 to 2 percent slopes, in native grass; 150 feet north and 100 feet west of where U.S. Highway 18 enters the east side of sec. 17, T. 39 N., R. 26 W.:

A11—0 to 3 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate, medium, granular structure; soft, very friable; mildly alkaline; clear, smooth boundary.

A12—3 to 9 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) when moist; moderate, me-

Figure 10.—Profile of a Richfield silt loam from an area of Richfield-Dawes silt loam, 0 to 2 percent slopes. The arrow points to an animal burrow.

dium, subangular blocky and moderate, medium, granular structure; hard, friable; mildly alkaline; clear, smooth boundary.

B21t—9 to 16 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, blocky; hard, firm; thin continuous clay films; moderately alkaline; clear, smooth boundary.

B22t—16 to 24 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, blocky; hard, firm; thin continuous clay films on vertical faces of peds and thin patchy clay films on horizontal faces of peds; moderately alkaline; clear, smooth boundary.

B3—24 to 30 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, blocky structure; hard, firm; thin patchy clay films; moderately alkaline; abrupt, wavy boundary.

C1—30 to 50 inches, light-gray (10YR 7/2) silt loam, pale brown (10YR 6/3) when moist; massive; soft, very friable; a few fine, distinct segregations of lime; moderately alkaline; abrupt, wavy boundary.

IIC2—50 to 60 inches, weakly cemented sandstone; bedded; calcareous; moderately alkaline.

The A horizon is loam or silt loam. The B2t horizon is clay loam, silty clay loam, or light silty clay. Depth to lime ranges from 20 to 38 inches. The silty loess in the C horizon commonly extends to a depth of 5 feet or more, but in places it is underlain by weakly cemented sandstone or sand at a depth of 40 to 60 inches.

Richfield soils are mapped with Dawes and Tuthill soils. Richfield and Keith soils formed in similar material. They do not have the A2 horizon present in Dawes soils and commonly contain less clay in the B2t horizon than those soils. They have a B2t horizon that is more clayey than that in Keith and Tuthill soils.

Richfield and Canyon soils, 9 to 21 percent slopes (RcE).—Richfield and Canyon soils in varying proportions are about 45 percent of this complex and other soils are 55 percent. This complex is in areas that are large and irregular in shape. Richfield soils are on the side slopes. They have a profile similar to that described as representative for the Richfield series, but the surface and subsoil layers are thinner, and depth to lime is about 20 inches. Canyon soils are on the ridgetops. They have the profile described as representative for the Canyon series.

Included with these soils in mapping are areas of Anselmo, Goshen, Ronson, and Tuthill soils. Anselmo soils are the most extensive of these inclusions and are on the lower part of slopes. Goshen soils are in swales. In places Ronson soils are on the upper part of slopes, and Tuthill soils are on middle and lower parts of slopes.

Surface runoff is medium to rapid on the soils of this complex. Canyon soils have very low available water capacity and are low in fertility and content of organic matter.

All areas are in native grass and are used for grazing. Slopes are either too steep or too irregular for cultivation of the soils. Canyon soils also are too shallow. Control of erosion is the main concern of management. Richfield: Silty range site; capability unit VIe-1; pasture group F; windbreak group 10. Canyon: Shallow range site; capability unit VIs-2; pasture group unassigned; windbreak group 10.

Richfield-Dawes silt loams, 0 to 2 percent slopes (RdA).—Richfield soils are 77 percent of this complex, Dawes soils 20 percent, and other soils 3 percent. This complex is in areas that are fairly large and irregular in shape. Richfield soils are on the long, smooth slopes, rises, and very gentle undulations. Dawes soils are on the flatter areas in slight depressions. These soils have the profile described as representative for their respective series.

Included with these soils in mapping are Goshen and Hoven soils. Goshen soils are in swales. Hoven soils are in low spots or in small depressions and are shown on the detailed map by the symbol for wet spot.

Surface runoff is slow on the soils of this complex. Dawes soils have slow permeability. Their claypan subsoil releases moisture slowly to plants, and these soils are somewhat droughty late in summer.

Winter wheat and alfalfa are the main crops in cultivated areas. Many areas are in native grass and are used for grazing. Conservation of moisture is the chief concern of management. Maintenance of tilth, fertility, and the content of organic matter are also concerns of management. Richfield: Silty range site; capability unit IIc-2; pasture group F; windbreak group 3. Dawes: Clayey

range site; capability unit IIs-1; pasture group E; windbreak group 4.

Richfield-Tuthill silt loams, 2 to 9 percent slopes (RhB).—Richfield soils are 45 percent of this complex, Tuthill soils 40 percent, and other soils 15 percent. This complex is in areas that are gently undulating to undulating and have a well-defined drainage pattern. Richfield and Tuthill soils are closely intermingled throughout the areas. The Richfield soils have a profile similar to that described as representative for the Richfield series, but the surface layer is slightly thinner and lime is at a depth of 27 inches. The surface layer of the Tuthill soil is silt loam and is thinner than that in the profile described as representative for the Tuthill series. The subsoil is clay loam and the underlying material is sandy loam. Surface runoff on the soils of this complex is medium.

Included with these soils in mapping are Hoven and Keya soils. Keya soils are more common and are in swales. Hoven soils are in small depressions that are less than 2 acres in size. They are shown on the detailed map by the symbol for wet spot. Also, in places are small slick spots that are shown on the detailed map by the symbol for slick spots.

Many areas are in native grass and are used for grazing. Winter wheat and alfalfa are the main crops. Control of erosion is the main concern of management. Maintenance of fertility and the content of organic matter are also concerns of management. Silty range site; capability unit IIIe-1; pasture group F; windbreak group 3.

Ronson Series

The Ronson series consists of nearly level to steep, calcareous, loamy soils that are moderately deep over calcareous sandstone. These soils are on uplands.

In a representative profile the surface layer is fine sandy loam about 12 inches thick. It is dark-gray in the upper part and grayish-brown in the lower part. Below this layer is a transitional layer of light-gray fine sandy loam about 3 inches thick. It is soft when dry and very friable when moist. The underlying material is very pale brown sandy loam. Weakly cemented, calcareous sandstone is at a depth of 35 inches.

Ronson soils are well drained. Surface runoff is slow to medium, and permeability is moderately rapid. Available water capacity is low. Fertility is low, and the content of organic matter is moderate to moderately low. Soil blowing is a hazard.

Nearly all areas are in native or tame grass and are used for grazing. Many areas that were formerly farmed are now seeded to native and tame grass or to alfalfa. In cultivated areas, these soils are better suited to early-maturing small grains than to row crops.

Representative profile of Ronson fine sandy loam from an area of Ronson-Anselmo fine sandy loams, 0 to 3 percent slopes; 900 feet south and 100 feet east of the NW. corner of sec. 21, T. 35 N., R. 27 W.:

Ap—0 to 4 inches, dark-gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

A12—4 to 12 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; soft, very friable; calcareous; moderately alkaline; clear, wavy boundary.

AC—12 to 15 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; soft, very friable; calcareous; moderately alkaline; clear, wavy boundary.

C1—15 to 35 inches, very pale brown (10YR 8/3) sandy loam, pale brown (10YR 6/3) when moist; weak, subangular blocky structure to massive; loose; calcareous; moderately alkaline; abrupt, wavy boundary.

C2—35 to 60 inches, very pale brown (10YR 8/3), weakly cemented sandstone, pale brown (10YR 6/3) when moist; bedded; calcareous; moderately alkaline.

The A and AC horizons range from fine sandy loam to sandy loam. In areas that have a cover of native grass the upper part of the A horizon commonly is noncalcareous. The A horizon ranges from 9 to 15 inches in thickness. The AC horizon is 3 to 8 inches in thickness. Bedded sandstone is at a depth of 20 to 40 inches. It is weakly cemented to strongly cemented and can be dug with a spade, but with difficulty.

Ronson soils are near or are mapped with Anselmo, Holt, and Tassel soils. Ronson soils are more calcareous and shallower to sandstone than Anselmo soils. They do not have a B horizon that is typical of Holt soils, and they are more calcareous than those soils. They have a thicker A horizon and are deeper over sandstone than Tassel soils.

Ronson-Anselmo fine sandy loams, 0 to 3 percent slopes (RnA).—Ronson soils are 55 percent of this complex, Anselmo soils 25 percent, and other soils 20 percent. This complex is in areas of moderate size on uplands. The relief is broken by very gentle rises and undulations. Ronson soils have the profile described as representative for the Ronson series. They are level to very gently sloping but have less slope than the Anselmo soils. Anselmo soils are on the sides of rises and undulations. Their surface layer is slightly thinner than that in the profile described as representative for the Anselmo series.

Included with these soils in mapping are Doger, Tassel, and Vetal soils. Doger soils are on the side slopes and in some of the swales. Tassel soils are on the top of some of the rises and undulations. Vetal soils are in swales.

Many areas are in native grass and are used for grazing. Spring-sown small grains and alfalfa are the main crops in cultivated areas. Ronson soils are better suited to these crops than to row crops. Ronson: Sandy range site; capability unit IIIe-9; pasture group H; windbreak group 8. Anselmo: Sandy range site; capability unit IIIe-7; pasture group H; windbreak group 5.

Ronson-Anselmo fine sandy loams, 3 to 5 percent slopes (RnB).—Ronson soils are 50 percent of this complex, Anselmo soils 30 percent, and other soils 20 percent. The soils in this complex are gently undulating. Ronson soils are on the upper part of side slopes. They have a thinner surface layer than that in the profile described as representative for the Ronson series. Anselmo soils are on the lower part of side slopes. They have a profile similar to that described as representative for the Anselmo series.

Included with these soils in mapping are Tassel, Tuthill, and Vetal soils. Tassel soils are on ridgetops. Tuthill soils are on the lower part of some side slopes. Vetal soils are in swales.

Surface runoff is slow to medium on the soils of this complex. Ronson soils have low available water capacity and are low in fertility.

Many areas are in native grass and are used for grazing. Oats and alfalfa are the main crops in cultivated areas. This complex is better suited to early-maturing, spring-

sown small grains than to row crops. Control of water erosion and soil blowing are the main concerns of management. Conservation of moisture and the improvement of fertility and content of organic matter are also concerns of management. Ronson: Sandy range site; capability unit IIIe-10; pasture group H; windbreak group 8. Anselmo: Sandy range site; capability unit IIIe-8; pasture group H; windbreak group 5.

Rough Broken Land

Rough broken land (25 to 70 percent slopes) (Ru) consists of mixed soils along the Little White River near Ghost Hawk Park. The areas extend southward to Spring Creek, and they extend back several miles on both sides of the river. They are large and irregular in shape and are dissected by deep canyons and ravines flanked by steep to very steep slopes (fig. 11). Small, spring-fed streams are in some of the larger ravines. Runoff is slow except on the included Epping and Tassel parts.

Most of the soils in this land type are deep and sandy, but some are shallow to sandstone. The surface layer is dark colored and commonly is loamy sand. Below this layer is fine sand that is calcareous at varying depths. In places a few fossilized bone fragments and rounded pebbles are in the profile.

Included with Rough broken land in mapping are Doger and Valentine soils. Doger soils are about 25 percent of the mapped areas and Valentine soils about 20 percent. Doger soils are on the lower part of slopes and in the bottom of ravines. Valentine soils are on the middle and upper parts of slopes in rolling to hilly areas below steep ridges and peaks. Also included in mapping are areas of Dunday, Elsmere, Epping, and Tassel soils. Dunday and Elsmere soils are on bottom lands and low terraces. Epping and Tassel soils are on the steep upper part of slopes, ridges, and peaks. In places are small areas of Rock outcrop.

All of the acreage is in native vegetation and is used for grazing, as wildlife habitat, and for recreation. The native vegetation consists of tall and mid grasses and thin to dense stands of ponderosa pine. Bur oak, ash, cottonwood, and chokecherry are among the native trees and shrubs along streams and drainageways. Control of soil blowing and water erosion are the main concerns of management. Savannah range site; capability unit VIIs-6; pasture group unassigned; windbreak group 10.

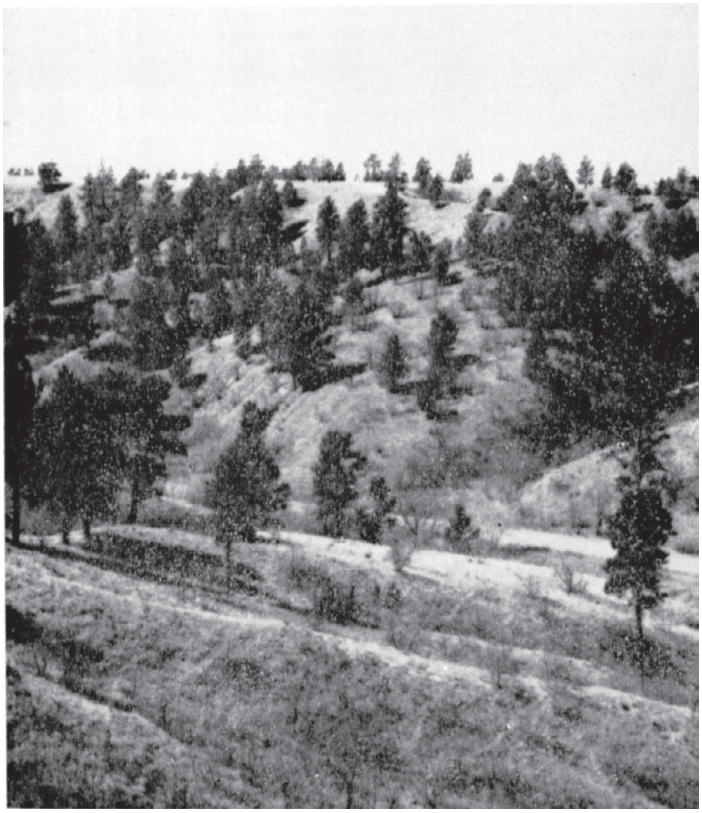


Figure 11.—Area of Rough broken land. (*Courtesy of the Bureau of Indian Affairs.*)

Saline Lowland

Saline lowland (0 to 1 percent slopes) (Sa) consists of mixed saline soils on bottom lands. The areas are long and narrow and are the headwaters of creeks that drain the south-central part of the county. In places small mounds and depressions make the surface uneven. Most of the soil material that makes up this land type is light colored, sandy, and strongly alkaline.

Included with Saline lowland in mapping are Elsmere and Whitelake soils. These soils are on the higher elevations.

Surface runoff is very slow, and it ponds in some of the lower areas. The water table generally is at a depth of less than 4 feet, and in places it is near the surface.

This land type is too saline and too wet for cultivation. All areas are in native grass and are used for grazing. The ponded areas provide nesting sites for waterfowl. Saline Lowland range site; capability unit VIIs-5; pasture group unassigned; windbreak group 10.

Samsil Series

The Samsil series consists of rolling to steep, clayey soils that are shallow to shale. These soils are on uplands. They formed in clayey material over soft shale.

In a representative profile the surface layer is dark grayish-brown clay about 4 inches thick. Below this layer is a transitional layer of grayish-brown clay about 4 inches thick. It is slightly hard when dry and firm when moist. The underlying material is grayish-brown shaly clay over olive-gray and grayish-brown soft shale at a depth of 13 inches.

Samsil soils are well drained. Surface runoff is rapid, and permeability is slow. Available water capacity is very low. Fertility and the content of organic matter are low. Erosion is a severe hazard.

All areas are in native grass and are used for grazing.

Representative profile of Samsil clay from an area of Samsil-Boyd clays, 19 to 30 percent slopes; 200 feet east and 200 feet north of the SW. corner of sec. 10, T. 39 N., R. 25 W.:

A1—0 to 4 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; weak,

fine, granular structure; slightly hard, firm; mildly alkaline; clear, smooth boundary.

AC—4 to 8 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, firm; moderately alkaline; clear, smooth boundary.

C1—8 to 13 inches, grayish-brown (2.5Y 5/2) shaly clay, dark grayish brown (2.5Y 4/2) when moist; bedded; moderately alkaline; clear, smooth boundary.

C2—13 to 60 inches, olive-gray (5Y 5/2) and grayish-brown (2.5Y 5/2) soft shale, very dark gray (5Y 3/1) and very dark grayish brown (2.5Y 3/2) when moist; bedded; moderately alkaline.

Depth to bedded shale ranges from 5 to 18 inches. The profile above the bedded shale commonly is calcareous, but in places it is noncalcareous. Shale fragments commonly are throughout the profile.

Samsil soils are mapped with Boyd soils and are near areas of Epping and Orella soils. Unlike Boyd soils, Samsil soils do not have a B horizon, and they are more shallow to shale. They are more clayey than Epping soils. They generally are less alkaline than Orella soils, and they contain less sodium.

Samsil-Boyd clays, 19 to 30 percent slopes (SbE).—Samsil soils are 55 percent of this complex, Boyd soils 40 percent, and other soils 5 percent. This complex is in areas that are moderate in size and irregular in shape. Slopes are steep and short. Surface runoff is rapid. Samsil soils are on the sides of buttes and peaks and on the shoulders of draws. They have the profile described as representative for the Samsil series. Boyd soils are on smoother and less steep side slopes. They have a profile similar to that described as representative for the Boyd series. Depth to shale is about 25 inches.

Included with these soils in mapping are Millboro soils and places where soft clay shale crops out. Millboro soils are on foot slopes. Shale crops out on the steep sides of some of the buttes and peaks.

All areas are in native grass and are used for grazing. This complex is too steep for cultivation. Control of erosion is the main concern of management. Samsil: Shallow range site; capability unit VIIs-2; pasture group unassigned; windbreak group 10. Boyd: Clayey range site; capability unit VIe-4; pasture group unassigned; windbreak group 10.

Sandy Alluvial Land

Sandy alluvial land (0 to 2 percent slopes) (Sd) consists of mixed soils that formed in alluvium, on bottom lands, on low terraces, and along narrow drainageways on uplands. Channels in which meandering streams flow dissect the long, narrow areas. These soils formed recently, and most of them are sandy.

Included with Sandy alluvial land in mapping are Dunday soils. They are in the higher parts of the mapped areas.

Surface runoff is slow, and floods are frequent in spring and in summer. Scouring and deposition of debris and fresh sediments are common during flooding.

All areas are in native vegetation and are used for grazing. In addition to tall and mid grasses, the native vegetation includes scattered stands and clumps of native trees and shrubs that provide cover for wildlife and winter protection for livestock. Overflow range site; capability unit VIw-3; pasture group unassigned; windbreak group 10.

Shena Series

The Shena series consists of nearly level to sloping silty soils that are shallow to siltstone. These soils are on uplands. They formed in silty material over siltstone.

In a representative profile the surface layer is dark-gray silt loam about 4 inches thick. The subsoil is dark grayish-brown silty clay about 8 inches thick. It is very hard when dry and firm when moist. The lower part contains many fine fragments of siltstone. The underlying material is very pale brown siltstone that is difficult to chip with a spade.

Shena soils are well drained. Surface runoff is medium to rapid, and permeability is moderately slow. Available water capacity is very low. Fertility is medium, and the content of organic matter is moderate. Erosion is a hazard in sloping areas.

Almost all areas are in native grass and are used for grazing. The soil is too shallow and too droughty for cultivated crops.

Representative profile of Shena silt loam, 0 to 9 percent slopes, in native grass; 2,015 feet south and 125 feet east of the NW. corner of sec. 12, T. 39 N., R. 31 W.:

A1—0 to 4 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure that parts to weak, medium and fine, granular; slightly hard, friable; neutral; clear, smooth boundary.

B21t—4 to 8 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, prismatic structure that parts to moderate, fine, subangular blocky; very hard, firm; a few, fine, pale-brown siltstone fragments 1 to 3 millimeters thick; thin continuous clay films; neutral; clear, smooth boundary.

B22t—8 to 12 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, blocky structure that parts to moderate, fine, subangular blocky; very hard, firm; pale-brown and brown siltstone fragments 2 to 5 millimeters in diameter are 20 to 25 percent, by volume, less than 1 percent are as much as 10 millimeters in diameter; siltstone fragments coated dark brown (10YR 4/3); thin, continuous clay films on faces of peds and on many of the siltstone fragments; neutral; clear, wavy boundary.

C—12 to 60 inches, very pale brown (10YR 7/3) siltstone, brown (7.5YR 5/4) when moist; bedded; mildly alkaline; difficult to chip with a spade.

The A horizon ranges from very dark grayish brown to grayish brown in 10YR hue. It is silt loam or silty clay loam. The B horizon is silty clay loam or silty clay. The B22t horizon commonly contains siltstone fragments that range from 2 to 15 millimeters in diameter and make up 15 to 35 percent of the horizon, by volume. Depth to hard siltstone is 7 to 15 inches.

Shena soils are near Epping, Huggins, Kadoka, Wanblee, and Wortman soils. Shena soils are shallower to siltstone than Huggins and Kadoka soils. Unlike Epping soils, they have a clayey B horizon. Unlike Wanblee and Wortman soils, they do not have an A2 horizon, and their B horizon contains less sodium than that of those soils.

Shena silt loam, 0 to 9 percent slopes (SnC).—This is the only Shena soil mapped in the county (fig. 12). It is on uplands. Slopes are moderate in length and are slightly convex.

Included with this soil in mapping are areas of Goshen, Huggins, Kadoka, and Okreek soils. Goshen soils are in swales. Huggins, Kadoka, and Okreek soils are on some of the middle and lower parts of slopes. These inclusions

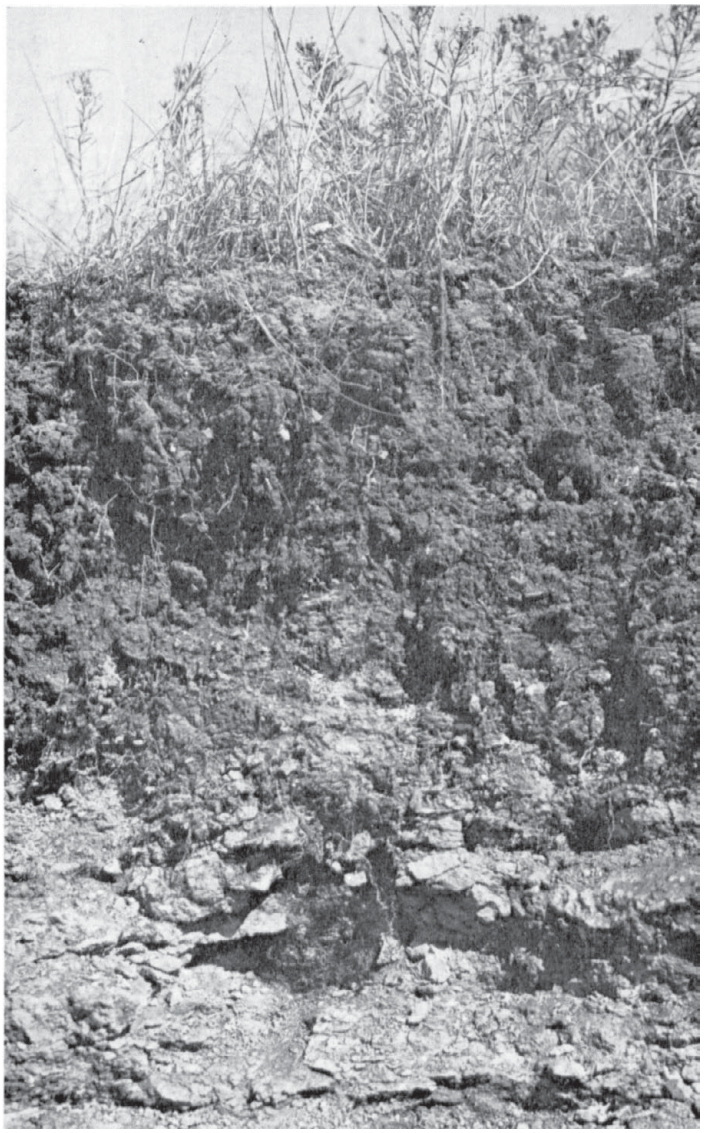


Figure 12.—Profile of Shena silt loam, 0 to 9 percent slopes.

are as much as 40 percent of some mapped areas of this soil.

Surface runoff is medium to rapid. Available water capacity is very low.

All areas of this soil are in native grass and are used for grazing.

This soil is too shallow and droughty for cultivation. Shallow range site; capability unit VIs-2; pasture group unassigned; windbreak group 10.

Tassel Series

The Tassel series consists of undulating to steep, calcareous, loamy soils that are shallow to calcareous sandstone (fig. 13). They are on upland ridges and rimrock areas.

In a representative profile the surface layer is gray fine sandy loam about 4 inches thick. Below this layer is a transitional layer of light brownish-gray sandy loam about 6 inches thick. It is soft when dry and very friable when moist. The underlying material is white loamy fine sand and sandstone to a depth of 60 inches.

Tassel soils are well drained. Surface runoff is rapid, and permeability is moderately rapid. Available water capacity is very low. Fertility and the content of organic matter are low. Soil blowing and water erosion are hazards.

Nearly all areas are in native grass and are used for grazing.

Representative profile of Tassel fine sandy loam from an area of Tassel-Ronson fine sandy loams, 3 to 30 percent slopes, in native grass; 1,240 feet west and 250 feet north of the SE. corner of sec. 18, T. 38 N., R. 28 W.:

A1—0 to 4 inches, gray (10YR 5/1) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

AC—4 to 10 inches, light brownish-gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) when moist; weak, coarse, subangular blocky structure that parts to weak, medium, granular; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

C—10 to 60 inches, white (10YR 8/2) loamy fine sand and

Figure 13.—Profile of a Tassel fine sandy loam. Sandstone is at a depth of about 10 inches.

sandstone, light gray (10YR 7/1) when moist; bedded; moderately cemented in upper part, and weakly cemented in lower part; calcareous; moderately alkaline.

The A horizon ranges from gray to light brownish gray of 10YR hue and from 2 to 6 inches in thickness.

The solum ranges from sandy loam to loamy fine sand. The sandstone is very weakly to strongly cemented.

Tassel soils have a thinner A horizon and are shallower to sandstone than the nearby Holt and Ronson soils. They contain more sand than the nearby Canyon soils.

Tassel-Rock outcrop complex, 25 to 40 percent slopes (TcF).—Tassel soils are 40 percent of this complex, Rock outcrop 20 percent, and other soils 40 percent. This complex is in large areas that are irregular in shape. It is on canyon walls and the steep sides of buttes (fig. 14). Tassel soils are on tops and sides of ridges near the areas of Rock outcrop. They have a profile similar to that described as representative for the Tassel series. Rock outcrop consists of rocky ledges of sandstone near the top of the sides of buttes and of almost vertical walls on the rims of canyons. It makes the areas appear craggy.

Included with this complex in mapping are Anselmo, Ronson, and Vetal soils. Anselmo and Ronson soils are on the middle and lower parts of side slopes. Vetal soils are in swales.

Surface runoff is rapid. Tassel soils have very low available water capacity and are droughty.

All areas are in native grass and are used for grazing. In the western part of the county, ponderosa pine grows singly or in clumps in and around areas of Rock outcrop. Control of water erosion and soil blowing are the main concerns of management. Tassel: Shallow range site; capability unit VIIe-4; pasture group unassigned; windbreak group 10. Rock outcrop: capability unit VIIIs-1; range site, pasture group, and windbreak group unassigned.

Tassel-Ronson fine sandy loams, 3 to 30 percent slopes (TfE).—Tassel soils are 50 percent of this complex, Ronson soils 25 percent, and other soils 25 percent. This complex is in long, narrow areas that are irregular in shape. Slopes commonly are short and are gently undulating to steep. Surface runoff is medium to rapid, and available water capacity is low to very low. Tassel soils are on ridgetops and on shoulders of the draws. They have the profile described as representative for the Tassel series. Ronson soils are on the upper part of side slopes. Their surface layer is thinner than that in the profile described as representative for the Ronson series.

Included with these soils in mapping are Anselmo and Vetal soils. Anselmo soils are more extensive, and they are on the lower and more gentle parts of side slopes. Vetal soils are in swales. Also included are small areas of Rock outcrop in some of the mapped areas.

All areas are in native grass and are used for grazing. The soils are too shallow or too steep for cultivation. Control of water erosion and soil blowing are the main concerns of management. Tassel: Shallow range site; capability unit VIIe-4; pasture group unassigned; windbreak group 10. Ronson: Sandy range site; capability unit VIe-6; pasture group unassigned; windbreak group 10.

Figure 14.—Area of Tassel-Rock outcrop complex, 25 to 40 percent slopes.

Tuthill Series

The Tuthill series consists of deep, nearly level to moderately steep, loamy soils on uplands. These soils formed in mixed loamy and sandy material.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 9 inches thick. The subsoil is about 20 inches thick. It is light brownish gray and is sandy clay loam in the upper part and sandy loam in the lower part. The upper part is very hard when dry and firm when moist. The underlying material is light-gray loamy sand to a depth of 48 inches. Below it is light-gray and white, calcareous loamy sand.

Tuthill soils are well drained. Surface runoff is slow to medium, and permeability is moderate. Available water capacity is moderate. Fertility is medium, and the content of organic matter is moderate. Soil blowing is a hazard in areas where the surface layer is fine sandy loam. Erosion is a hazard in sloping areas.

Tuthill soils are well suited to all crops commonly grown in the county. Less than half of the acreage is cultivated. Many areas were formerly farmed, but they are now in native or tame grasses and are used for grazing.

Representative profile of Tuthill fine sandy loam from an area of Tuthill-Anselmo fine sandy loams, 3 to 9 percent slopes; 150 feet south and 250 feet east of the NW. corner of sec. 11, T. 38 N., R. 29 W.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; cloddy and weak, medium, granular structure; soft, friable; neutral; abrupt, smooth boundary.

A12—5 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish-brown (10YR 3/2) when moist; very weak, coarse, prismatic structure that parts to weak, medium and fine, subangular blocky; slightly hard, friable; neutral; clear, wavy boundary.

B21t—9 to 14 inches, light brownish-gray (10YR 6/2) light sandy clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, slightly sticky; thin, distinct, mostly continuous clay films on vertical faces of peds, bridging between sand grains; neutral; clear, wavy boundary.

B22t—14 to 24 inches, light brownish-gray (10YR 6/2) sandy clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, blocky; very hard, firm, sticky and slightly plastic; thin distinct continuous clay films on faces of peds, bridging between sand grains; neutral; clear, wavy boundary.

B3—24 to 29 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky; thin, distinct, continuous clay films on vertical faces and patchy clay films on horizontal faces of peds; neutral; clear, wavy boundary.

IIC1—29 to 48 inches, light-gray (10YR 7/2) loamy sand, brown (10YR 5/3) when moist; weak, subangular blocky structure and single grain; soft, loose; mildly alkaline; gradual boundary.

IIC2—48 to 60 inches, light-gray (10YR 7/2) and white (10YR 8/1) loamy sand, light brownish gray (10YR 6/3) and light gray (10YR 7/2) when moist; single grain; loose; calcareous; moderately alkaline.

The A horizon ranges from silt loam to fine sandy loam in texture and from 4 to 10 inches in thickness. Texture of the B2t horizon is sandy clay loam to clay loam. The C horizon commonly is loamy sand but in places is as fine as loam. In places weakly cemented sandstone is at a depth of 40 to 60 inches.

Tuthill soils are near or are mapped with Anselmo, Holt, Richfield, and Vetal soils. Tuthill soils have a more clayey B horizon than Anselmo and Holt soils. They have more sand and less clay in the B horizon than Richfield soils. Unlike Vetal soils, they have a B horizon, and they have a thinner A horizon than those soils.

Tuthill silt loam, 0 to 3 percent slopes (ThA).—This soil is on uplands. The areas are on tablelands that have a poorly defined drainage pattern. This soil has a profile similar to that described as representative for the series, except that the surface layer is silt loam about 6 inches thick. Also, the subsoil is clay loam, and the underlying material is loam and sandy loam (fig. 15). Surface runoff is slow.

Included with this soil in mapping are Hoven and Keya soils. Hoven soils are in small depressions less than 2 acres in size. They are shown on the detailed map by the symbol for wet spot. Keya soils are in swales. These inclusions are about 10 percent of any mapped area of this soil.

Figure 15.—**Profile of Tuthill silt loam, 0 to 3 percent slopes.**

About half of the acreage is cultivated. Winter wheat and alfalfa are the main crops. Other areas are in native grass and are used for grazing and for hay. Conservation of moisture and maintenance of fertility and content of organic matter are the main concerns of management. Silty range site; capability unit IIc-2; pasture group F; windbreak group 3.

Tuthill silt loam, 3 to 5 percent slopes (ThB).—This soil is on uplands. It is gently undulating. The areas are fairly large and irregular in shape. Drainage patterns are well defined. Slopes are short and convex. The surface layer is more silty and is thinner than that in the profile described as representative for the series. Surface runoff is medium.

Included with this soil in mapping are Hoven, Keya, Mosher, and Richfield soils. Hoven soils are in small depressions less than 2 acres in size. They are shown on the detailed map by the symbol for wet spot. Keya and Mosher soils are in swales. Richfield soils are on the top of low ridges. These inclusions are as much as 25 percent of any mapped area of this soil.

About one-third of the acreage is cultivated. Winter wheat and alfalfa are the main crops. Many areas are in native grass and are used for grazing. Control of erosion is the main concern of management. Maintenance of fertility and content of organic matter are also concerns of management. Silty range site; capability unit IIe-1; pasture group F; windbreak group 3.

Tuthill silt loam, 5 to 9 percent slopes (ThC).—This soil is on uplands. It is undulating. The areas are large and irregular in shape. Drainage patterns are well defined. Slopes are slightly convex and commonly are about 300 to 400 feet in length. Surface runoff is medium. The surface layer is more silty and is thinner than that in the profile described as representative for the series.

Included with this soil in mapping are Hoven, Keya, and Mosher soils. Hoven soils are in depressions. Keya and Mosher soils are in swales. These inclusions are less than 20 percent of any mapped area of this soil.

Most areas are in native grass and are used for grazing. Small grains and alfalfa are the main crops in cultivated areas. Control of erosion is the main concern of management. Maintenance of fertility and the content of organic matter are also concerns of management. Silty range site; capability unit IIIe-1; pasture group F; windbreak group 3.

Tuthill-Anselmo fine sandy loams, 3 to 9 percent slopes (TnC).—Tuthill soils are 55 percent of this complex, Anselmo soils 20 percent, and other soils 25 percent. This complex is in areas that are large and irregular in shape. Slopes are convex and range from 400 to 600 feet in length. Surface runoff is slow to medium. Tuthill soils are on the upper part of side slopes and ridges. They have the profile described as representative for the Tuthill series. Anselmo soils are on the lower part of side slopes. Most of the slopes are less than 5 percent. Anselmo soils have a profile similar to that described as representative for the Anselmo series.

Included with these soils in mapping are areas of Hoven and Vetal soils. Hoven soils are in small depressions and are shown on the detailed map by the symbol for wet spot. Vetal soils are in swales. Also included are areas of a well-drained soil that is similar to the Tuthill soil in texture of the surface layer, but its subsoil contains less clay.

Most areas are in native grass and used for grazing. Spring-sown small grains and alfalfa are the main crops in cultivated areas. Control of soil blowing and water erosion are the main concerns of management. Maintenance of fertility and the content of organic matter are also important concerns of management. Tuthill: Sandy range site; capability unit IVe-8; pasture group H; windbreak group 5. Anselmo: Sandy range site; capability unit IIIe-8; pasture group H; windbreak group 5.

Tuthill-Tassel fine sandy loams, 3 to 9 percent slopes (TtC).—Tuthill soils are 35 percent of this complex, Tassel soils 30 percent, and other soils 35 percent. Most of the sloping areas are long and narrow. Surface runoff is medium to rapid. Tuthill soils are on the upper part of side slopes. Their surface layer is thinner than that in the profile described as representative for the Tuthill series. They are underlain by silty material weathered from siltstone. Tassel soils are on ridges and on the shoulders of draws. Their profile is similar to that described as representative for the Tassel series, except that the underlying sandstone is less gray and more brownish or buff colored.

Included with these soils in mapping are Anselmo and Vetal soils. Anselmo soils are on the lower and more undulating parts of side slopes. Vetal soils are in swales. Also included are areas of a well-drained soil that is similar to the Tuthill soil in texture of the surface layer, but its subsoil contains less clay.

Control of water erosion and soil blowing are the main concerns of management. Maintenance of fertility and content of organic matter are also concerns of management.

Most areas are in native grass and are used for grazing. Spring-sown small grains and grain sorghums are the main crops in cultivated areas. Tassel soils are too shallow for cultivation. Tuthill: Sandy range site; capability unit IVe-8; pasture group H; windbreak group 5. Tassel: Shallow range site; capability unit VIe-10; pasture group unassigned; windbreak group 10.

Tuthill-Vetal fine sandy loams, 0 to 3 percent slopes (TvA).—Tuthill soils are 50 percent of this complex, Vetal soils 28 percent, and other soils 22 percent. The areas are irregular in shape and very gently undulating. surface runoff is slow. Tuthill soils are on the slight rises and the side slopes of the undulations. Vetal soils are in swales and depressed areas. Each soil has a profile similar to that described as representative for its respective series.

Included with these soils in mapping are Anselmo soils, which are on the higher and steeper undulations. Also included are areas of a well-drained soil that is similar to the Tuthill soil in texture of the surface layer, but its subsoil contains less clay.

Many areas are cultivated. Spring-sown small grains, alfalfa, and corn are the main crops. Other areas are in native grass and are used for grazing and for hay. Control of soil blowing is the main concern of management. Maintenance of fertility and content of organic matter are also concerns of management. Tuthill: Sandy range site; capability unit IIIe–7; pasture group H; windbreak group 5. Vetal: Sandy range site; capability unit IIIe–7; pasture group H; windbreak group 1.

Tuthill-Wortman fine sandy loams, 0 to 3 percent slopes (TwA).—Tuthill soils are 45 percent of this complex, Wortman soils 25 percent, and other soils 30 percent. The areas are irregular in shape and are slightly undulating. Drainage patterns are poorly defined. Tuthill soils are on the rises and undulations. They have a profile similar to that described as representative for the Tuthill series. Wortman soils are in swales and in low areas. Slightly raised mounds and very small depressions make the surface uneven in these areas. The surface layer of the Wortman soils is more sandy than that in the profile described as representative for the Wortman series.

Included with these soils in mapping are Anselmo and Vetal soils. Anselmo soils are intermingled with Tuthill soils on the undulations. Vetal soils are in some of the swales.

Surface runoff is slow. Permeability is moderate in the Tuthill soils, and it is very slow in the dense claypan subsoil of the Wortman soils.

Many areas were formerly cultivated but are now in native or tame grasses and are used for grazing. Alfalfa is the main crop in cultivated areas. Control of soil blowing is the main concern of management. Tuthill: Sandy range site; capability unit IIIe-7; pasture group H; windbreak group 5. Wortman: Sandy range site; capability unit IVe-13; pasture group H; windbreak group 9.

Valentine Series

The Valentine series consists of deep, undulating to steep soils on uplands. These soils formed in wind-deposited sand.

In a representative profile the surface layer is dark grayish-brown fine sand about 3 inches thick. Below this layer is a transitional layer of brown fine sand about 9 inches thick. The underlying material is light-gray fine sand to a depth of 60 inches. The entire profile is loose in consistence.

Valentine soils are excessively drained. Surface runoff is very slow, and permeability is rapid. Available water capacity is low. Valentine soils are low in fertility and content of organic matter. Soil blowing is a severe hazard.

Nearly all areas are in native grass and are used for grazing. Native hay is harvested on some of the more gently sloping soils. Water for livestock can be obtained from shallow wells.

Representative profile of Valentine fine sand, 5 to 30 percent slopes; 1,500 feet north and 450 feet east of the SW. corner of sec. 7, T. 36 N., R. 31 W.:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure that parts to single grain; loose; neutral; clear, smooth boundary.

AC—3 to 12 inches, brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) when moist; single grain; loose; neutral; gradual, smooth boundary.

C—12 to 60 inches, light-gray (10YR 7/2) fine sand, pale brown (10YR 6/3) when moist; single grain; loose; neutral.

The A horizon is fine sand or loamy fine sand and ranges from 2 to 5 inches in thickness. The AC horizon is 6 to 12 inches in thickness. The lower part of the C horizon is calcareous in places where the sandy deposits are thin over calcareous sandstone.

Valentine soils are near Dunday and Elsmere soils, but they have a thinner A horizon that those soils. Unlike Elsmere soils, Valentine soils do not have a water table at a depth of 2 to 6 feet.

Valentine fine sand, 5 to 30 percent slopes (VaE).—This soil is in areas that are as much as several thousand acres in size. It has the profile described as representative for the series. It is the principal soil in the Sandhills part of the county. There is no defined drainage pattern. Slopes are short and well rounded. Many slopes do not exceed 15 percent, but in places the slopes are steeper and angular in shape.

Surface runoff is very slow because rainfall enters the soil readily. Permeability is rapid.

All areas are in native grass and are used for grazing. This soil is too sandy for cultivation. Control of soil blowing is the main concern of management. Sands range site; capability unit VIe-7; pasture group unassigned; windbreak group 7.

Valentine-Dunday complex, 3 to 9 percent slopes (VdC).—Valentine soils are 55 percent of this complex, Dunday soils 35 percent, and other soils 10 percent. This complex is gently undulating to undulating. The areas are irregular in shape. Surface drainage patterns are poorly defined. Surface runoff is very slow. Valentine soils are on the well-rounded upper part of slopes, and Dunday soils are on the lower part of side slopes. Each soil has a profile similar to that described as representative for its respective series.

Included with these soils in mapping are Doger and Vetal soils in swales.

All areas are in native grass and are used for grazing and for hay. Control of soil blowing is the main concern of management. These soils are too sandy and too low in fertility for cultivation. Sands range site; capability unit VIe-7; pasture group unassigned; windbreak group 7.

Valentine-Tassel complex, 5 to 30 percent slopes (VsE).—Valentine soils are 55 percent of this complex, Tassel soils 25 percent, and other soils 20 percent. This complex is in large areas that are irregular in shape. It consists of steep canyons and draws that extend into sandy uplands. Valentine soils are on the side slopes and in gently sloping areas above the heads of canyons. The more steeply sloping Tassel soils are on peaks, ridges, and the upper part of slopes that rim the canyons. Each soil has a profile similar to that described as representative for its respective series.

Included with these soils in mapping are Anselmo, Dunday, and Vetal soils and small areas of Rock outcrop. Anselmo and Dunday soils are on the lower part of some of the more gentle slopes. Vetal soils are in swales. Rock outcrop is in small areas on the side of some of the peaks and ridges and is in rimrock areas on the edge of canyons.

Surface runoff generally is very slow, but it is rapid on Tassel soils and Rock outcrop.

All areas are in native grass and are used for grazing. These soils are too sandy or are too shallow and steep for cultivation. Control of soil blowing and water erosion are the main concerns of management. Valentine: Sands range site; capability unit VIe-7; pasture group unassigned; windbreak group 7. Tassel: Shallow range site; capability unit VIIe-4; pasture group unassigned; windbreak group 10.

Vetal Series

The Vetal series consists of deep, nearly level to gently sloping, loamy soils. These soils are on uplands on flats and in swales. They formed in sandy alluvium washed in from adjacent soils.

In a representative profile the surface layer is dark-gray fine sandy loam and sandy loam about 12 inches thick. Below this layer is a transitional layer of dark grayish-brown sandy loam about 23 inches thick. It is soft when dry and very friable when moist. The underlying material is grayish-brown sandy loam in the upper part and is pale-brown loamy sand below 44 inches.

Vetal soils are well drained. Surface runoff is slow, and permeability is moderately rapid. Available water capacity is moderate. Fertility and the content of organic matter are high. Soil blowing is a hazard.

Use of these soils depends on the use of nearby soils. Spring-sown small grains, alfalfa, and corn are the main crops in cultivated areas. Other areas are in native grass and are used for grazing and for hay.

Representative profile of Vetal fine sandy loam; 1,850 feet east and 75 feet south of the NW. corner of sec. 16, T. 37 N., R. 29 W.:

Ap—0 to 5 inches, dark-gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, coarse, platy structure that parts to weak, fine, subangular blocky; soft, very friable; neutral; abrupt, smooth boundary.

A12—5 to 12 inches, dark-gray (10YR 4/1) sandy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure that parts to weak, medium and fine, subangular blocky; slightly hard, friable; neutral; clear, smooth boundary.

AC1—12 to 20 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; very weak, medium, prismatic structure that parts to weak, fine and medium, subangular blocky; soft, friable; neutral; clear, smooth boundary.

AC2—20 to 35 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; very weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; soft, friable; mildly alkaline; gradual, wavy boundary.

C1—35 to 44 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) when moist; very weak, coarse, subangular blocky structure; soft, friable; mildly alkaline; gradual, smooth boundary.

C2—44 to 60 inches, pale-brown (10YR 6/3) loamy sand, grayish brown (10YR 5/2) when moist; single grained; loose; mildly alkaline.

The combined thickness of the A and AC horizons ranges from 20 to 60 inches. Texture of the C horizon is sandy loam to find sand. In places weakly cemented, calcareous sandstone is between a depth of 40 to 60 inches. Buried horizons are in the C horizon in places.

Vetal soils are near or are mapped with Anselmo, Doger, and Tuthill soils. Their color of very dark grayish brown or darker when moist is at a greater depth than in those soils. They are more sandy than Tuthill soils and are less sandy than Doger soils. They are more sandy than Keya soils, and, unlike those soils, they do not have a B horizon.

Vetal fine sandy loam (0 to 2 percent slopes) (Vf).—This soil has the profile described as representative for the series. It is in areas that are long and narrow in swales on uplands. Slopes are slightly concave.

Included with this soil in mapping are Anselmo, Keya, and Tuthill soils. Anselmo and Tuthill soils are on the outer edges of the mapped areas. Keya soils are intermingled with the Vetal soils in some areas. These inclusions are less than 15 percent of any mapped area of this soil.

Surface runoff is slow, and permeability is moderately rapid. Fertility and content of organic matter are high.

About half of the acreage is cultivated. Spring-sown small grains, alfalfa, and corn are the main crops. Control of soil blowing is the main concern of management. Sandy range site; capability unit IIIe-7; pasture group H; windbreak group 1.

Wanblee Series

The Wanblee series consists of moderately deep, nearly level to gently sloping, silty soils that have a claypan subsoil. These soils are moderately deep over siltstone. They formed in material weathered from the underlying siltstone and are on uplands.

In a representative profile the surface layer is gray silt loam about 2 inches thick. The subsoil is about 6 inches thick. It is grayish-brown clay in the upper part and very pale brown calcareous clay loam in the lower part. The underlying material is very pale brown, calcareous loam. Very pale brown, calcareous, soft siltstone is at a depth of 22 inches.

Wanblee soils are somewhat poorly drained. Surface runoff is slow, and water ponds for brief periods. Permeability is slow, and available water capacity is low. Fertility and content of organic matter are low.

All areas are in native grass and are used for grazing.

Representative profile of Wanblee silt loam from an area of Wanblee-Wortman silt loams, 0 to 6 percent slopes; 1,848 feet west and 100 feet south of the NE. corner of sec. 13, T. 36 N., R. 25 W.:

A2—0 to 2 inches, light-gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; thin, hard crust with platy structure in upper ¼ inch, and massive below with fine vesicular openings; soft, very friable; moderately alkaline; abrupt, irregular boundary.

B2t—2 to 5 inches, grayish-brown (10YR 5/2) light clay, dark grayish brown (10YR 4/2) when moist; moderate, medium and fine, columnar structure that parts to moderate, fine, blocky; extremely hard, very firm; continuous clay films on faces of peds; light-gray (10YR 6/1) silt loam coats peds in upper ½ to 1 inch of horizon; calcareous; strongly alkaline; clear, smooth boundary.

B3sa—5 to 8 inches, very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; hard, friable; a few fine siltstone particles; few fine segregations of salt; calcareous; strongly alkaline; gradual, wavy boundary.

C1sa—8 to 22 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; very weak, fine, subangular blocky structure to massive; slightly hard, friable; common very fine siltstone fragments and particles; calcareous; strongly alkaline; clear, wavy boundary.

C2—22 to 60 inches, very pale brown (10YR 8/3) soft siltstone, pale brown (10YR 6/3) when moist; bedded; crushes readily to silt loam; calcareous; strongly alkaline.

The A2 horizon is silt loam or loam and ranges from ½ to 3 inches in thickness. The B2t horizon is clay loam or light clay and is dark grayish brown to light brownish gray in color and 2 to 9 inches in thickness. Depth to bedded siltstone is 15 to 30 inches.

Wanblee soils have a thinner A horizon than Wortman soils with which they are mapped. Unlike Minatare soils, which have a similar profile, Wanblee soils have siltstone in the C

horizon at a moderate depth and are not so deep as those soils. Unlike Huggins soils, which are included in mapping, they have an A2 horizon and contain more sodium.

Wanblee-Wortman silt loams, 0 to 6 percent slopes (WbA).—Wanblee soils are 45 percent of this complex, Wortman soils 35 percent, and other soils 20 percent. This complex is along drainageways on uplands. The areas are irregular in shape. The soils commonly are nearly level but are gently sloping along the outer edges of the areas. Slightly raised mounds and small depressions make the surface uneven. Wanblee soils are in depressions in areas that are 2 or more feet wide. They have the profile described as representative for the Wanblee series. Wortman soils are on mounds and have a profile similar to that described as representative for the Wortman series.

Included with these soils in mapping are Huggins soils and other soils of minor extent. Huggins soils are on the higher levels and on the outer edges of the areas.

Surface runoff is slow, and water ponds for short periods on the Wanblee soils. Permeability is slow to very slow, and the dense claypan subsoil releases moisture slowly to plants.

All areas are in native grass and are used for grazing. Wanblee soils are not suitable for cultivation. They are so closely intermingled with Wortman soils that in most places cultivation of this complex is not practical. Wanblee: Thin Claypan range site; capability unit VIs-1; pasture group unassigned; windbreak group 10. Wortman: Claypan range site; capability unit IVs-2; pasture group C; windbreak group 9.

Wann Series

The Wann series consists of deep, nearly level, loamy soils that have a fluctuating water table. These soils formed in sandy alluvium and are on low terraces and on bottom lands.

In a representative profile the surface layer is about 9 inches thick. It is dark-gray sandy loam in the upper part and dark grayish-brown fine sandy loam in the lower part. Below this layer is a transitional layer of grayish-brown fine sandy loam about 8 inches thick. It is slightly hard when dry and friable when moist. The layers of underlying material range from fine sandy loam to loamy sand.

Wann soils are somewhat poorly drained. Surface runoff is slow, and permeability is moderately rapid. Depth to the water table is 3 to 6 feet, but it fluctuates seasonally. Available water capacity is moderate. These soils are medium in fertility and moderate in content of organic matter. Soil blowing is a hazard in plowed areas.

These soils are suited to cultivated crops. They are better suited to small grains and alfalfa than to corn, but corn is grown in areas that have a deeper water table. Many areas are used for growing alfalfa.

Representative profile of Wann sandy loam; 2,640 feet north and 100 feet east of the SW. corner of sec. 24, T. 38 N., R. 27 W.:

A11—0 to 4 inches, dark-gray (10YR 4/1) sandy loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, granular structure; soft, friable; neutral; clear, smooth boundary.

A12—4 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure; slightly hard, friable; neutral; clear, smooth boundary.

AC—9 to 17 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard, friable; a few fine salt crystals; mildly alkaline; abrupt, smooth boundary.

C1—17 to 36 inches, light brownish-gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

C2—36 to 46 inches, grayish-brown (10YR 5/2) heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

C3—46 to 54 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; single grain; soft, friable; calcareous; moderately alkaline; clear, smooth boundary.

C4—54 to 60 inches, light-gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) when moist; single grain; calcareous; moderately alkaline.

The A horizon ranges from sandy loam to loam in texture and from 8 to 11 inches in thickness. In places salt crystals are not present in the AC and C horizons. Depth to carbonates is 8 to 22 inches. The C horizon varies greatly in sequence and in texture. In places mottles that disappear when the soil is dry are in the C horizon. Buried soil horizons are common.

Wann, Chappell, Elsmere, and Vetal soils formed in similar material. Wann soils are less sandy than Elsmere soils. They have a thinner A horizon and are more calcareous than Vetal soils, which are better drained. Unlike Chappell soils, which are well drained, they do not have a B horizon and are deeper over sand and gravel.

Wann sandy loam (0 to 3 percent slopes) (Wd).—This soil is on bottom lands in the loops of larger streams. The areas are small and irregular. This soil has the profile described as representative for the series.

Included with this soil in mapping are Elsmere, Mosher, and Whitelake soils. Elsmere soils are near stream channels. Mosher and Whitelake soils are on the outer edges of the areas next to foot slopes of adjacent terrace escarpments. These inclusions are less than 15 percent of any mapped area of this soil.

Surface runoff is slow, and permeability is moderately rapid. In wet years the high water table delays planting and affects growth of crops. In dry years control of soil blowing is a concern of management.

Most areas are cultivated. Alfalfa and small grains are the main crops. Subirrigated range site; capability unit IIIw-5; pasture group A; windbreak group 2.

Wann loam, depressional (0 to 1 percent slopes) (We).—This soil is in areas on bottom lands and in depressions. It is in areas that are long and narrow. The drainage pattern is poorly defined. This soil has a profile similar to that described as representative for the series, but the surface layer is loam.

Included with this soil in mapping are Doger and Elsmere soils. They are on undulations. Elsmere soils are more extensive and are as much as 30 percent of some mapped areas.

Surface runoff is slow, and permeability is moderately rapid. In wet years the high water table delays planting and affects crop growth.

Nearly all areas are in native grass and are used for hay and grazing. Alfalfa is the main crop in cultivated areas. Oats and corn also are grown. Subirrigated range site; capability unit IIIw-5; pasture group A; windbreak group 2.

Whitelake Series

The Whitelake series consists of deep, nearly level, loamy soils that have a claypan subsoil. These soils formed in alluvium and are on terraces, on bottom lands, and in broad basins or depressions.

In a representative profile the surface layer is very dark grayish-brown fine sandy loam about 15 inches thick. Below this layer is a subsurface layer of grayish-brown loamy fine sand about 2 inches thick. The subsoil is fine sandy loam about 12 inches thick. It is pale brown in the upper part and light brownish gray in the lower part. The upper part is extremely hard when dry and very firm when moist. The underlying material is pale-brown and grayish-brown sandy loam over very pale brown silt loam.

Whitelake soils are moderately well drained. Surface runoff is slow, and permeability is slow. The water table is within 5 feet of the surface during wet periods. Available water capacity is moderate. Fertility is medium, and the content of organic matter is moderate.

Most areas are in native grass. Alfalfa is the main crop in cultivated areas.

Representative profile of Whitelake fine sandy loam, 0 to 3 percent slopes; 700 feet west and 200 feet north of the center of sec. 11, T. 37 N., R. 27 W.:

A11—0 to 6 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft, very friable; neutral; clear, smooth boundary.

A12—6 to 15 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure that parts to weak, medium, granular; soft, very friable; neutral; abrupt, smooth boundary.

A2—15 to 17 inches, grayish-brown (10YR 5/2) loamy fine sand, dark gray (10YR 4/1) when moist; single grain; loose; neutral; abrupt, smooth boundary.

B2t—17 to 22 inches, pale-brown (10YR 6/3) heavy fine sandy loam, dark grayish brown (10YR 4/2) when moist; very dark gray (10YR 3/1) moist coatings on ped surfaces; strong, medium, columnar structure; extremely hard, very firm; very thin, continuous clay films and bridging on vertical faces of peds; mildly alkaline; clear, smooth boundary.

B3—22 to 29 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, blocky; very hard, firm; thin, continuous clay films and bridging; moderately alkaline; clear, smooth boundary.

C1—29 to 35 inches, pale-brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable; moderately alkaline; abrupt, smooth boundary.

C2ca—35 to 55 inches, grayish-brown (10YR 5/2) light sandy loam, very dark grayish brown (10YR 3/2) when moist in upper part, and grading to very pale brown (10YR 8/3), pale brown (10YR 6/3) when moist, in lower part; massive; hard, firm; few to common fine lime segregations; calcareous in spots; strongly alkaline; clear, smooth boundary.

IIC3—55 to 60 inches, very pale brown (10YR 8/3) silt loam, light brown (7.5YR 6/4) when moist; massive; soft, friable; calcareous; strongly alkaline.

The A1 horizon ranges from 10 to 22 inches in thickness. The C horizon commonly is stratified material that ranges from sand to loam or silt loam. The lower part of the C horizon commonly is calcareous, but in places the entire profile is noncalcareous. Buried soil horizons are common, and in places soft sandstone or siltstone is at a depth of 40 to 60 inches.

Whitelake soils have a thicker A1 horizon and are more sandy than Mosher and Wortman soils, which have a similar profile.

Whitelake fine sandy loam, 0 to 3 percent slopes (WhA).—This is the only Whitelake soil mapped in the county. It is in areas that are large and irregular. Slightly elevated mounds and small depressions make the surface uneven in most places.

Included with this soil in mapping are Anselmo, Chappell, Mosher, and Vetal soils. These inclusions are in a random pattern and are less than 15 percent of any mapped area of this soil.

Surface runoff is slow. Permeability is slow in the claypan subsoil.

Most areas are in native grass and are used for hay and grazing. Alfalfa is the main crop in cultivated areas, but some spring-sown small grains are also grown. Control of soil blowing is the main concern of management. Sandy range site; capability unit IVe-13; pasture group H; windbreak group 5.

Wortman Series

The Wortman series consists of nearly level to gently sloping silty and loamy soils that have a claypan subsoil. These soils are moderately deep over siltstone. They formed in material weathered from the underlying soft siltstone and are on uplands.

In a representative profile the surface layer is grayish-brown silt loam about 6 inches thick. Below this layer is a subsurface layer of light-gray silt loam about 2 inches thick. The subsoil is about 16 inches thick. It is grayish-brown clay in the upper part, brown heavy clay loam in the middle part, and pale-brown light clay loam in the lower part. The underlying material is light-gray, calcareous loam over pinkish-white, soft siltstone at a depth of 34 inches.

Wortman soils are moderately well drained or well drained. Surface runoff is slow to medium, and permeability is very slow. Available water capacity is low. Fertility is medium to low, and content of organic matter is moderate.

Most areas are in native grass and are used for grazing. Alfalfa is the main crop in cultivated areas. Some wheat is grown where these soils are associated with Huggins and Kadoka soils.

Representative profile of Wortman silt loam, 0 to 6 percent slopes; 2,340 feet west and 150 feet south of the NE. corner of sec. 34, T. 39 N., R. 28 W.:

A1—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

A2—6 to 8 inches, light-gray (10YR 6/1) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and thin, platy structure that parts to very weak, fine and medium, subangular blocky; slightly hard, friable; neutral; abrupt, irregular boundary.

B21t—8 to 11 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, columnar structure; extremely hard, very firm; thin, continuous clay films on faces of peds; upper ½ to ¾ inch of columns coated with material and has color of A2 horizon; mildly alkaline; clear, smooth boundary.

B22t—11 to 15 inches, brown (10YR 5/3) heavy clay loam, dark grayish brown (10YR 4/2) when moist;

slightly darker coatings on peds; weak, medium, prismatic structure that parts to strong, fine, blocky; hard, firm; continuous clay films on faces of peds; a few fine siltstone particles; moderately alkaline; clear, wavy boundary.

B3—15 to 24 inches, pale-brown (10YR 6/3) light clay loam, brown (10YR 5/3) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable; 5 to 10 percent of volume is fine siltstone fragments; many fine, distinct threads of lime and many segregations of salt; matrix is noncalcareous; strongly alkaline; gradual, wavy boundary.

C1—24 to 34 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable; calcareous; strongly alkaline; clear, wavy boundary.

C2—34 to 60 inches, pinkish-white (7.5YR 8/2) soft siltstone, light brown (7.5YR 6/4) when moist; bedded; calcareous; strongly alkaline; can be easily dug with a spade.

The A horizon ranges from fine sandy loam to silt loam in texture and from 4 to 11 inches in thickness. The B2t horizon is clay loam, silty clay loam, or clay and is 4 to 12 inches in thickness. In places the B3 horizon is moderately alkaline. The C horizon ranges from loam to clay loam or silty clay loam in texture. Depth to soft siltstone is 20 to 40 inches.

Wortman soils are near Huggins and Kadoka soils. Unlike Huggins and Kadoka soils, Wortman soils have an A2 horizon. Their Bt horizon is more clayey than that in Kadoka soils. Their profile is similar to that of Mosher soils, but their Bt horizon is less gray than that in Mosher soils. Unlike Mosher soils, they are underlain by soft siltstone at a depth of less than 40 inches.

Wortman fine sandy loam, 0 to 3 percent slopes (WoA).—This soil is on flats along drainageways on uplands. Slightly elevated mounds interspersed with small depressions make the surface uneven in some places. This soil has a profile similar to that described as representative for the series, but the surface layer is fine sandy loam.

Included with this soil in mapping are Keya, Tuthill, Vetal, and Wanblee soils. Keya and Vetal soils are in swales and along drainage channels in some places. Tuthill soils are on the outer edges of the areas and on some of the more distinct mounds. Wanblee soils are in some of the small depressions or low spots. These inclusions are as much as 50 percent of some mapped areas.

Surface runoff is slow. Permeability is very slow, and the dense claypan subsoil releases moisture slowly to plants.

Nearly all areas are in native grass and are used for grazing. Alfalfa and spring-sown small grains are the main crops in cultivated areas. Control of soil blowing is the main concern of management. Sandy range site; capability unit IVe-13; pasture group H; windbreak group 9.

Wortman silt loam, 0 to 6 percent slopes (WrA).—This soil is in areas that are irregular in shape. Slopes are nearly level, but mounds about 6 inches above the intervening low spots make the surface uneven. This soil has the profile described as representative for the series.

Included with this soil in mapping are Goshen, Huggins, Kadoka, and Wanblee soils. Goshen soils are in swales. Huggins and Kadoka soils are on the higher levels, commonly on the outer edges of the mapped areas. Wanblee soils are in some of the small low spots. These inclusions are as much as 30 percent of some mapped areas.

Surface runoff is slow, and permeability is very slow. The dense claypan subsoil releases moisture slowly to plants, and the soil is droughty late in summer. Tilth deteriorates quickly in cultivated areas.

Most areas are in native grass and are used for grazing. Alfalfa and winter wheat are the main crops in cultivated areas. This soil is better suited to these crops than to row crops. Conservation of moisture and the improvement of tilth are concerns of management. Claypan range site; capability unit IVs-2; pasture group C; windbreak group 9.

Use and Management of the Soils

This section discusses the use and management of the soils as range, for cropland, for tame pasture, for windbreaks, as wildlife habitat, and for engineering purposes.

Use of the Soils as Range [2]

Todd County is in a broad transitional area between the higher moisture regime of the true prairie to the east and the mixed prairie on the drier plains to the west. Mid grasses are dominant in the original vegetation on most of the upland areas, but tall grasses are dominant in areas that have favorable moisture regimes. Short grasses are more evident on sites where moisture regimes are less favorable. Both warm-season and cool-season grasses are present, but the warm-season grasses are dominant in the more sandy parts of the county.

Native vegetation grows in about 87 percent of the county. Native grass for grazing and hay is a major crop. It furnishes grazing throughout much of the year and provides feed for breeding herds during periods of snow cover. Beef cattle are the main livestock, but there are some dairy cattle, as well as sheep and horses.

Range sites and condition classes

Range sites are distinctive kinds of rangeland that differ in their potential to produce native plants. They are the product of all environmental factors responsible for their development. In the absence of abnormal disturbance and physical site deterioration, they support a plant community that differs from that of other sites in terms of kind and proportion of plants or in total annual yield.

Range condition is the present state of vegetation in relation to the climax, or original, vegetation for a site. Range condition classes are an expression of the degree to which the present composition, expressed in percent, has departed from that of the climax vegetation of a range site.

Four range condition classes are recognized: excellent, good, fair, and poor. A range is in *excellent condition* if 76 to 100 percent of the vegetation is that of the climax vegetation for that site. It is in *good condition* if the percentage is 51 through 75; in *fair condition* if the percentage is 26 through 50; and in *poor condition* if the percentage is 25 or less.

The purpose of determining range condition is to measure changes that have taken place in the plant cover and to

[2] By Dwaine C. Smith, range conservationist, Soil Conservation Service.

thereby have a basis for predicting the nature of plant community changes to be expected from management and treatment.

A range condition guide for each range site is used to help determine the condition of the site. The plants on a specific range site are classified, according to their response to grazing, as decreasers, increasers, and invaders.

Decreasers are plants in the climax vegetation of a site that decrease in number when the site is subjected to continuous close grazing. *Increasers* are plants in the climax vegetation that increase in relative abundance when the site is subjected to close grazing. Invaders are plants that are not members of the climax plant community for the site but that invade areas where the climax vegetation is depleted.

Descriptions of range sites

The soils of Todd County are grouped into 16 range sites, which are described in the following pages. Important soil characteristics, principal plants, and estimates of yields are described for each range site. Yield estimates are for range sites in excellent condition and are based on clipping studies and grazing trials. The estimates are for the entire annual growth above ground and not for what would be removed by normal grazing or haying use.

The names of soil series in each range site are stated, but this does not mean that all the soils in a given series are in that site. To find the range site in which a given soil is placed, and the page on which it is described, turn to the "Guide to Mapping Units" at the back of this survey.

WETLAND RANGE SITE

This site consists of soils of the Gannett series and of Peaty muck on bottom lands and broad basins in the Sandhills. Gannett soils have a thin layer of peat and muck over sandy loam and fine sand. Peaty muck consists of peat deposits, ranging from 3 to 10 feet in thickness, layered with thin lenses of fine sand. The water table rises to or above the surface for short periods in spring and is within 3 feet of the surface during the growing season. This site is too wet and too poorly aerated for big bluestem, but it has a potential for luxuriant stands of water-tolerant grasses and sedges.

Prairie cordgrass, blue joint reedgrass, and northern reedgrass are the main grasses. Reed canarygrass, slough sedge, and Kentucky bluegrass are also present in lesser amounts. Indigobush amorpha, a shrub, is present in places. Continued overuse of this site results in an increase of Kentucky bluegrass.

Many areas are used for hay. Fencing this site away from drier upland sites and following basic range management practice help to maintain this site in excellent or good condition. Where outlets are available, open drains help to regulate the depth of the water table. Protection from fires is needed in areas of Peaty muck because peat fires are difficult to extinguish.

If this site is in excellent condition, the total annual air-dry yield ranges from 5,000 pounds per acre in a dry year to 6,000 pounds per acre in a favorable year.

SUBIRRIGATED RANGE SITE

This site consists of deep, somewhat poorly drained to very poorly drained, sandy and loamy soils of the Elsmere, Loup, and Wann series. These soils are in depressions in the Sandhills and on bottom lands and low terraces. In spring the water table rises to the surface for short periods and is at a depth of 3 to 6 feet during the growing season. The soils are sufficiently aerated for such grasses as big bluestem and have abundant moisture supplies to produce luxuriant stands of tall and mid grasses.

The major grasses are big bluestem, indiangrass, little bluestem, and switchgrass. Prairie cordgrass, western wheatgrass, slender wheatgrass, Kentucky bluegrass, sedges, and forbs are present in lesser amounts. Where this site is closely grazed, Kentucky bluegrass, western wheatgrass, and the sedges increase. Under continued overuse, the tall and mid grasses are replaced by inland saltgrass, foxtail barley, and unpalatable forbs.

Many areas are used for native hay. This site is easier to maintain in excellent or good condition than sites on uplands because supplies of soil moisture are more constant. Fencing this site apart from sites on uplands helps to maintain it in excellent or good condition.

If this site is in excellent condition, the estimated total annual air-dry yield ranges from 4,500 pounds per acre in a dry year to 5,500 pounds per acre in a favorable year.

SALINE LOWLAND RANGE SITE

Saline lowland is the only mapping unit in this range site. It consists of mixed, poorly drained soils that formed in alluvium on bottom lands. The soils are high in salts and are strongly alkaline. The fluctuating water table causes salts to accumulate near the surface and in the root zone in amounts sufficient to affect the kinds of plants present.

Nuttall alkaligrass, alkali cordgrass, and alkali sacaton are important grasses when this site is in excellent condition. Small amounts of western wheatgrass, switchgrass, inland saltgrass, and slim sedge are also present. If this site is overgrazed, inland saltgrass becomes dominant and replaces the more palatable and more productive taller grasses. Most areas are used for grazing.

If this site is in excellent condition, the estimated total annual air-dry yield ranges from 2,500 pounds per acre in a dry year to 4,000 pounds per acre in a favorable year.

OVERFLOW RANGE SITE

This site consists of deep, silty and loamy soils of the Goshen and Keya series and of the mixed alluvial soils of Loamy alluvial land and Sandy alluvial land. These soils are in swales on uplands and on bottom lands. They generally receive additional moisture in the form of runoff from adjacent soils or from overflow of streams. The additional moisture gives this site a potential to produce dense stands of tall and mid grasses.

Big bluestem, switchgrass, green needlegrass, Canada wildrye, and slender wheatgrass are important grasses when this site is in excellent condition. Western wheatgrass, blue grama, prairie sandreed, side-oats grama, needle-and-thread, and Kentucky bluegrass are also present in smaller amounts. Western wheatgrass and blue grama replace the taller grasses in areas of Goshen and Keya soils that have been continuously overused. In areas of Loamy alluvial land and Sandy alluvial land that have been continuously overused, western wheatgrass, side-

465-344—74——4

oats grama, needle-and-thread, and Kentucky bluegrass increase.

Hay can be cut every year from those areas used for hay without deterioration of the stand. Management that allows full use in a short period is more desirable than season-long use. Areas in poor or fair condition improve if use is deferred following reseeding or interseeding.

If this site is in excellent condition, the estimated total annual air-dry yield ranges from 2,600 pounds per acre in a dry year to 3,900 pounds per acre in a favorable year.

CLOSED DEPRESSION RANGE SITE

Hoven silt loam, 0 to 1 percent slopes, is the only soil in this range site. It receives additional moisture in the form of runoff from adjacent soils. Surface water ponds and remains until it evaporates. Permeability is very slow.

Western wheatgrass is the main plant when this site is in excellent condition. Big bluestem, switchgrass, blue grama, buffalograss, and inland saltgrass are also present in small amounts. In places western wheatgrass appears to be the only grass. Sedges, rushes, and smart weed appear during wet periods.

This site is used for grazing and for hay. The areas are small and, because livestock prefer them and graze them closely, range management is difficult. The small size of most areas makes separate management impractical.

If this site is in excellent condition, the total annual air-dry yield ranges from 2,300 pounds per acre in a dry year to 3,500 pounds per acre in a favorable year.

SAVANNAH RANGE SITE

Rough broken land is the only mapping unit in this site. It consists of mixed, mostly deep, sandy soils on uplands. The soils are steep to very steep.

The native vegetation consists of tall and mid grasses and scattered stands of ponderosa pine and bur oak. The trees commonly are less than 50 feet in height at maturity, but in a few places the pine trees are of merchantable size. If this site is in excellent condition, the main grasses are sand bluestem, little bluestem, big bluestem, prairie sandreed, Canada wildrye, and switchgrass. Small amounts of needle-and-thread and blue grama are also present.

Careful management is needed on this site to prevent soil blowing, for blowouts occur in closely grazed areas. Parts of the areas are used for timber, for grazing, as wildlife habitat, and for recreational purposes.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,800 pounds per acre in a dry year to 3,000 pounds per acre in a favorable year. About 80 percent of this estimated yield is from plants that provide forage for cattle.

SANDS RANGE SITE

This site consists of moderately deep and deep, loose, sandy soils of the Duda, Dunday, and Valentine series. These soils are on uplands and on low terraces along streams. They have low to very low available water capacity, but they readily absorb precipitation.

If this site is in excellent condition (fig. 16), such tall and mid grasses as sand bluestem, little bluestem, switch-

Figure 16.—Area of Sands range site in excellent condition. (*Courtesy of the Bureau of Indian Affairs.*)

grass, indiangrass, and prairie sandreed are dominant. Big bluestem, side-oats grama, blue grama, prairie junegrass, and needle-and-thread are also present. If this site is overgrazed, prairie sandreed replaces the bluestem.

The dominant warm-season grasses on this site make it well suited to grazing in summer. Careful management is needed to prevent soil blowing, for blowouts occur in closely grazed areas. Areas in fair condition improve if grazing is deferred. On some areas in poor condition, dune stabilization measures are needed to help restore vegetation.

If this site is in excellent condition, the total annual air-dry yield ranges from 2,100 pounds per acre in a dry year to 2,700 pounds per acre in a favorable year.

SANDY RANGE SITE

This site consists of deep and moderately deep, loamy and sandy soils of the Anselmo, Chappell, Doger, Dunday, Holt, Ronson, Tuthill, Vetal, Whitelake, and Wortman series. These soils are on uplands and terraces, and formed in moderately sandy to sandy material. Except in the Whitelake and Wortman soils, water intake is moderate to rapid. Available water capacity is moderate to very low, but the sandy material releases moisture readily to plants.

If this site is in excellent condition, the main grasses are little bluestem, big bluestem, prairie sandreed, needle-and-thread, and western wheatgrass. Lesser amounts of sand bluestem, blue grama, and side-oats grama are also present. If the site is constantly grazed, the bluestems are replaced by the other grasses. With further overuse these grasses are replaced by sand dropseed, threadleaf sedge, and blue grama. Seeding or interseeding (fig. 17) with adapted kinds of grass helps to restore areas in poor or fair condition to excellent condition.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,900 pounds per acre in a dry year to 2,700 pounds per acre in a favorable year.

SILTY RANGE SITE

This site consists of moderately deep and deep, loamy and silty soils of the Altvan, Kadoka, Keith, Richfield, and Tuthill series. These soils are on uplands. All of these soils have moderate permeability except the Richfield soils, which have moderately slow permeability. Available water capacity is moderate to high except for Altvan soils, which have low to moderate available water capacity.

If this site is in excellent condition, the main grasses are green needlegrass, western wheatgrass, needle-and-thread, and blue grama. Small amounts of little bluestem, side-oats grama, and threadleaf sedge also are present. Where the site is overused, western wheatgrass and needle-and-thread become dominant. Blue grama becomes dominant if this site is overgrazed.

This site is used for grazing and for hay. When used for hay, mowing in alternate years helps to maintain condition. The most practical means of improving areas in poor condition in some places is to seed them with climax kinds of grasses.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,600 pounds per acre in a dry year to 2,600 pounds per acre in a favorable year.

Figure 17.—**Interseeding adapted kinds of grass in an area of Tuthill-Wortman fine sandy loams, 0 to 3 percent slopes, to be used as range.**

CLAYEY RANGE SITE

This site consists of moderately deep and deep, silty and clayey soils of the Boyd, Dawes, Huggins, Millboro, and Okreek series. These soils are on uplands. They have a clayey subsoil that has moderately slow to slow permeability. Available water capacity is low to moderate.

If this site is in excellent condition the main grasses are western wheatgrass and green needlegrass and smaller amounts of blue grama and buffalograss. Where it is overused, western wheatgrass replaces green needlegrass, and if heavy grazing is continued, blue grama and buffalograss become dominant.

Areas that are in good condition or poorer can be improved if grazing is deferred for either a season or a year. Mechanical treatment and seeding practices can also be used to improve the condition of this site.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,500 pounds per acre in a dry year to 2,600 pounds per acre in a favorable year.

THIN UPLAND RANGE SITE

This site consists of moderately deep calcareous, silty soils of the Keota series. These soils are on uplands. Surface runoff is rapid, and fertility and the content of organic matter are low.

If this site is in excellent condition, the main grasses are little bluestem, side-oats grama, green needlegrass, and needle-and-thread. Western wheatgrass and blue grama

also are present in lesser amounts. Under continued overuse, the site becomes dominantly blue grama.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,500 pounds per acre in a dry year to 2,000 pounds per acre in a favorable year.

SHALLOW RANGE SITE

This site consists of shallow soils of the Canyon, Epping, Orella, Samsil, Shena, and Tassel series. These soils are on uplands. They are underlain by sandstone, siltstone, or shale at a depth of less than 20 inches. Surface runoff is medium to rapid, and available water capacity is very low. The underlying bedrock material restricts the penetration of plant roots.

If this site is in excellent condition, the major grasses are little bluestem, side-oats grama, blue grama, and needle-and-thread. Green needlegrass, western wheatgrass, hairy grama, and dryland sedges are also present in smaller amounts. Where this site is overused, little bluestem decreases and is replaced by the grama grasses. Under continued overuse, the site becomes bare of vegetation in places, and erosion is a hazard.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,300 pounds per acre in a dry year to 1,900 pounds per acre in a favorable year.

SHALLOW TO GRAVEL RANGE SITE

This site consists of loamy soils of the Dix series. These soils are shallow to sand and gravel, and they have low or very low available water capacity. Permeability is rapid.

If this site is in excellent condition, the main grasses are needle-and-thread, blue grama, and threadleaf sedge. Plains muhly, side-oats grama, sand dropseed, and forbs also are present. Where the site is overused, the short grasses become dominant.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,200 pounds per acre in a dry year to 1,700 pounds per acre in a favorable year.

CLAYPAN RANGE SITE

This site consists of deep and moderately deep soils of the Mosher and Wortman series. These soils have a silty surface layer over a dense claypan subsoil that restricts the movement of water, air, and plant roots.

If this site is in excellent condition, the main grasses are western wheatgrass, green needlegrass, needle-and-thread, and blue grama. Smaller amounts of side-oats grama, buffalograss, and inland saltgrass are also present. Under continued overuse, the site becomes dominated by blue grama and buffalograss.

If this site is in excellent condition, the total annual air-dry yield ranges from 1,100 pounds per acre in a dry year to 1,800 pounds per acre in a favorable year.

THIN CLAYPAN RANGE SITE

This site consists of deep and moderately deep soils of the Minatare and Wanblee series and also the drained phase of the Hoven series. These soils have a thin silty surface layer over a dense claypan subsoil. Permeability is slow to very slow. The subsoils of the Minatare and Wanblee soils are strongly alkaline, and in places accumulations of salts are evident in the lower part of the subsoil.

If this site is in excellent condition, the main grasses are western wheatgrass, blue grama, and buffalograss. Needle-and-thread, inland saltgrass, forbs, and pricklypear are also present in smaller amounts. Under continued overuse, the site becomes dominated by blue grama, buffalograss, and inland saltgrass. There is also an increase in pricklypear, and in dry years many places have no plant cover.

If this site is in excellent condition, the total annual air-dry yield ranges from 600 pounds per acre in a dry year to 1,200 pounds per acre in a favorable year.

VERY SHALLOW RANGE SITE

Gravelly land is the only mapping unit in this range site. It consists of mixed gravelly soils. In many areas gravel and sand are 10 inches or less from the surface. Available water capacity is very low.

If this site is in excellent condition, the main grasses are needle-and-thread, blue grama, hairy grama, and dryland sedges. Smaller amounts of side-oats grama, sand dropseed, forbs, and shrubs are also present. Where overused, this site deteriorates to a thin stand of blue grama, threadleaf sedge, and unpalatable forbs.

If this site is in excellent condition, the total annual air-dry yield ranges from 600 pounds per acre in a dry year to 1,200 pounds per acre in a favorable year.

Range management

Range is an important resource in Todd County, and its management is the key to soil and water conservation in the county. Control of erosion and conservation of moisture are required to help sustain yields of forage.

Proper use of range is basic to meeting these management needs. It requires the range manager to understand the capabilities and limitations of each range site in his pastures in terms of the kinds and quantity of forage it can be expected to produce. Forage production is dependent on soil moisture. Because rainfall varies widely from one year to another in Todd County, flexibility in numbers of livestock is needed in managing the range.

Other measures that help to meet management needs on range are proper season of use; deferment of grazing; distribution of grazing; range seeding and interseeding; mechanical treatments, such as pitting and contour furrowing; dune stabilization; control of fires, brush, and weeds; and spreading water.

Additional information about range management can be obtained from the local offices of the Soil Conservation Service and the Bureau of Indian Affairs.

General Management of Cropland [3]

Cropland is about 13 percent of the land area of Todd County. Much of it is in associations 1 and 4, but small areas are scattered throughout the county. Alfalfa is the main crop. Winter wheat, oats, corn, sorghum, barley, and tame grasses are important. Winter wheat alternated with a fallow period of 1 year (called summer fallow), and row crops alternated with small grain are the cropping systems that generally are used. The long-range system usually includes several years in alfalfa or tame grasses.

[3] By WALTER N. PARMETER, conservation agronomist, Soil Conservation Service.

Some areas that were formerly used for growing annual crops are now used for tame pasture or hay or they have been permitted to revert to native grass.

The main management practices needed are those that conserve moisture, control erosion and soil blowing, and maintain tilth, fertility, and the content of organic matter.

Moisture is conserved by reducing evaporation, limiting surface runoff, increasing intake of moisture, and controlling weeds. Practices that help to achieve these objectives are stubble mulching (fig. 18), management of crop residue, contour farming, contour stripcropping, terracing, use of field windbreaks, minimum tillage, and chiseling and subsoiling. Timely tillage is important on clayey soils, such as Millboro. Summer fallow alternated with winter wheat helps to control weeds as well as to store moisture.

Many of the preceding practices are also effective for controlling erosion and soil blowing. In addition, a grass cover on natural drainageways helps to prevent the formation of gullies. Wind stripcropping and cover crops help to control soil blowing. Emergency tillage roughens the ground surface and reduces soil blowing until more lasting measures are put into effect.

Chiseling and subsoiling help to improve water intake into claypan and clayey subsoils and help to break up plowpans in such soils as the Kadoka, Keith, and Richfield soils. Timely tillage on the Millboro and other clayey soils helps to maintain tilth of the surface layer. Use of green-manure crops and animal manure, use of grasses and legumes in the cropping system, and use of crop residue management, including stubble mulching, also help to maintain tilth as well as to maintain or improve fertility and content of organic matter.

On many soils in Todd County, applications of chemical fertilizers are needed if desired crop yields are to be obtained. Most of the soils that have been cultivated for any length of time show some evidence of being deficient in nitrogen. Moderately sandy and sandy soils, such as Anselmo and Dunday, are likely to be low in phosphorus. Soils high in lime, such as Keota and Ronson, are likely to be low in available nitrogen and phosphorus.

The use of fertilizer on the soils of this county is likely to increase. Information about the use of fertilizer can be obtained from the local offices of the Soil Conservation Service and the County Agricultural Extension Agent.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Figure 18.—**Stubble mulching on Millboro silty clay, 2 to 5 percent slopes. (*Courtesy of the South Dakota State University.*)**

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in Todd County.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass. A complete discussion of the capability classification is given in Agricultural Handbook 210 (*5*).

Management by capability units

In the following pages, each of the capability units in Todd County is described, and suggestions for the use and management of the soils in each unit are given. The capability units within a capability subclass are not numbered consecutively, because not all of the units in the state-wide system are used.

The names of the soil series represented are mentioned in the description of each unit, but this does not mean that all the soils in a given series are in the unit. The capability classification of each soil in Todd County is given in the "Guide to Mapping Units."

CAPABILITY UNIT IIe-1

This unit consists of moderately deep and deep, gently sloping, silty soils of the Kadoka and Tuthill series. These soils have a surface layer of silt loam and a subsoil of silty clay loam or clay loam.

These soils are in good tilth. Fertility is medium, and the content of organic matter is moderate. Available water capacity is moderate, and surface runoff is medium. Control of erosion is the main concern of management. Other concerns are control of soil blowing, conservation of moisture, and the maintenance of tilth, fertility, and the content of organic matter.

Winter wheat and alfalfa are the main crops. The soils are also suited to corn, sorghum, small grains, and tame grasses. Winter wheat is alternated with summer fallow.

Planting grasses and legumes in rotation, planting green-manure crops, and using stubble mulching and crop residue help to control erosion and soil blowing, to conserve moisture, and to maintain tilth, fertility, and the content of organic matter. Contour farming, contour stripcropping, and terracing are measures that help to control erosion and to conserve moisture on longer slopes. A grass cover helps to keep natural drainageways from eroding.

CAPABILITY UNIT IIs-1

This unit consists of deep, nearly level, silty soils of the Dawes series. The subsoil is silty clay loam or silty clay.

The surface layer is easily tilled, but permeability is slow in the claypan subsoil. Fertility is medium, and the content of organic matter is moderate. Surface runoff is slow, and available water capacity is moderate; but the claypan subsoil releases moisture slowly to plants, and the soil is somewhat droughty late in summer. Conserving moisture and improving the water intake of the subsoil are the main concerns of management. Control of soil blowing and maintenance of tilth, fertility, and the content of organic matter are other concerns of management.

Winter wheat and alfalfa are the main crops. This soil is also suited to small grains and tame grasses. Corn and

sorghum do well only in years of above normal precipitation. Winter wheat alternated with summer fallow is the cropping system commonly used.

Stubble mulching and chiseling and subsoiling help to improve water intake, to control soil blowing, and to maintain tilth, fertility, and the content of organic matter. Planting alfalfa in rotation with another crop also helps to improve penetration of moisture into the subsoil. Wind stripcropping helps to control soil blowing.

CAPABILITY UNIT IIc–2

This unit consists of moderately deep and deep, nearly level, silty soils of the Kadoka, Keith, Richfield, and Tuthill series. These soils have a surface layer of silt loam and a subsoil of silty clay loam or clay loam.

These soils are in good tilth. Fertility is medium, and content of organic matter is moderate. Surface runoff is slow, and available water capacity is moderate to high. Conservation of moisture, control of soil blowing, and maintenance of tilth, fertility, and the content of organic matter are concerns of management.

Winter wheat and alfalfa are the main crops, but the soils are suited to all crops grown in the county. Winter wheat alternated with summer fallow is the common cropping system. Planting of row crops, small grains, and alfalfa is another cropping system commonly in use.

Stubble mulching, chiseling and subsoiling, and the use of green-manure crops help to conserve moisture, to control soil blowing, and to maintain tilth, fertility, and content of organic matter. Wind stripcropping helps to control soil blowing. Single-row windbreaks are used successfully on the soils of this unit to help distribute snow for moisture conservation.

CAPABILITY UNIT IIc–3

This unit consists of deep, nearly level, silty and loamy soils of the Goshen and Keya series. These soils are in swales on uplands and commonly receive additional moisture in the form of runoff from adjacent soils.

These soils are in good tilth. Fertility and the content of organic matter are high. Permeability is moderate, and available water capacity is high. During wet years planting sometimes is delayed because of wetness, but in other years conservation of moisture is the main concern of management. Other concerns of management include maintenance of tilth, fertility, and the content of organic matter.

Winter wheat and alfalfa are the main crops, but these soils are suited to all crops grown in the county. The use of these soils is governed by the use of adjacent soils.

Stubble mulching and chiseling and subsoiling help to conserve moisture and to maintain tilth, fertility, and the content of organic matter. Reducing runoff from nearby soils does much to control the occasional periods of wetness in these soils. A grass cover on the waterways helps to prevent the formation of gullies and to provide drainage of excess water.

CAPABILITY UNIT IIIe–1

This unit consists of moderately deep and deep, sloping, silty soils of the Kadoka, Keith, Richfield, and Tuthill series. These soils are on uplands. They have a surface layer of silt loam and a subsoil of silty clay loam or clay loam. Some areas are slightly to moderately eroded.

Soils of this unit are in good tilth. Fertility is medium, and the content of organic matter is moderate. Permeability is moderate, except in the Richfield soils, where permeability is moderately slow. Available water capacity is moderate to high. Surface runoff is medium. Control of water erosion is the main concern of management. Other concerns of management include control of soil blowing, conservation of moisture, and maintenance of tilth, fertility, and the content of organic matter.

Winter wheat and alfalfa are the main crops, but the soils are suited to all crops grown in the county. A sequence of winter wheat alternated with summer fallow and a sequence that includes row crops, small grains, and alfalfa are the cropping systems commonly in use.

Terracing or contour stripcropping in combination with stubble mulching or use of crop residue help to control water erosion and soil blowing, to conserve moisture, and to maintain tilth, fertility, and the content of organic matter. The use of alfalfa and tame grasses in the cropping system and the use of green-manure crops also help to achieve management goals. A grass cover on the natural drainageways helps to prevent the formation of gullies.

CAPABILITY UNIT IIIe–4

Millboro silty clay, 2 to 5 percent slopes, is the only soil in this unit. It is on uplands and is gently sloping. Some of the cultivated areas are slightly to moderately eroded.

This soil is medium in fertility and moderate in content of organic matter. When the soil is moist it is in good tilth. If this soil is tilled when it is wet, however, tilth deteriorates. When the soil is dry, it is very hard. Available water capacity is moderate to low. Permeability is slow, but the soil cracks when it is dry, and water intake is aided until the soil swells and the cracks close. Control of soil blowing and water erosion are the main concerns of management. Other concerns include the conservation of moisture and the maintenance of tilth, fertility, and the content of organic matter.

Winter wheat, oats, sorghum, and alfalfa are the main crops. Winter wheat alternated with summer fallow and a sequence of row crops, oats, and alfalfa are the commonly used cropping systems.

Stubble mulching, chiseling and subsoiling, and wind stripcropping, along with the use of green-manure crops, help to control soil blowing and water erosion, to conserve moisture, and to maintain tilth, fertility, and content of organic matter. If grasses and legumes are not in the cropping system, terraces or contour stripcropping generally are necessary to help to control erosion. A grass cover on natural drainageways helps to prevent the formation of gullies.

CAPABILITY UNIT IIIe–6

Altvan loam, 2 to 5 percent slopes, is the only soil in this unit. It is moderately deep over gravel. Some cultivated areas are slightly eroded to moderately eroded.

This soil is in good tilth. Fertility is medium, and the content of organic matter is moderate. Available water capacity is low to moderate, and the soil is droughty. Surface runoff is medium. The main concerns of management are control of water erosion and conservation of moisture. Other concerns are the control of soil blowing and maintenance of tilth, fertility, and the content of organic matter.

Small grains are the main crops. The lack of moisture late in summer makes this soil better suited to these crops than to row crops. Alfalfa generally produces only one cutting. Winter wheat is grown in some areas, but the moisture stored in a fallow period is limited.

Stubble mulching, contour farming or contour stripcropping, and the use of green-manure crops and grasses and legumes in the cropping system help to control erosion, to conserve moisture, and to maintain fertility, tilth, and the content of organic matter. The moderate depth to gravel makes use of terraces undesirable.

CAPABILITY UNIT IIIe–7

This unit consists of deep, nearly level, loamy soils of the Anselmo, Tuthill, and Vetal series. These soils have a surface layer of fine sandy loam.

Fertility is medium to high, and the content of organic matter is moderate to high. Permeability is moderately rapid in the Anselmo and Vetal soils and moderate in the Tuthill soils. Available water capacity is moderate to low. Control of soil blowing and conservation of moisture are the main concerns of management. Maintenance of fertility and the content of organic matter are also important.

Spring-sown small grains, corn, and alfalfa are the main crops. The soils are also well suited to sorghums and to tame grasses. The cropping system most commonly used consists of row crops alternated with small grains.

Wind stripcropping, stubble mulching or crop residue management, and use of green-manure crops help to control soil blowing, to conserve moisture, and to maintain fertility and the content of organic matter. Field windbreaks also help to control soil blowing and to conserve moisture.

CAPABILITY UNIT IIIe–8

This unit consists of deep, gently undulating and gently sloping, loamy soils of the Anselmo and Vetal series. The upper layers of these soils are fine sandy loam or sandy loam, and the lower layers are loamy sand. Some of the cultivated areas are slightly eroded.

Fertility is medium to high, and the content of organic matter is moderate to high. Permeability is moderately rapid, and available water capacity is moderate to low. Surface runoff is slow to medium. Control of soil blowing and conservation of moisture are the main concerns of management. Other concerns of management include control of water erosion and maintenance of fertility and the content of organic matter.

Spring-sown small grains, corn, and alfalfa are the main crops. The soils are also suited to sorghums and to tame grasses. The cropping system commonly used is row crops, small grains, and alfalfa.

Wind stripcropping, stubble mulching or use of crop residue, and the use of green-manure crops help to control soil blowing and water erosion, to conserve moisture, and to maintain fertility and the content of organic matter. Field windbreaks also help to control soil blowing and to conserve moisture. Contour stripcropping helps to control erosion on the more uniform and longer slopes.

CAPABILITY UNIT IIIe–9

This unit consists of moderately deep, nearly level, loamy soils of the Chappell, Holt, and Ronson series. These soils have a fine sandy loam surface layer and a subsoil of sandy loam. Chappell soils are underlain by sand and gravel, and the Holt and Ronson soils are underlain by sandstone.

Fertility is medium to low, and the content of organic matter is moderate to moderately low. These soils are easily tilled, and they take in water readily. Available water capacity is low to very low, and the soils are droughty. Control of soil blowing and conservation of moisture are the main concerns of management. Improvement of fertility and content of organic matter are also important.

Spring-sown small grains and alfalfa are the main crops. Because these soils are droughty, row crops fail to do well in most years.

Wind stripcropping, stubble mulching, use of green-manure crops, and field windbreaks help to control soil blowing, to conserve moisture, and to improve fertility and the content of organic matter.

CAPABILITY UNIT IIIe–10

This unit consists of moderately deep, gently sloping and gently undulating, loamy soils of the Chappell and Ronson series. The surface layer of these soils is fine sandy loam, and the subsoil is sandy loam. Chappell soils are moderately deep over gravel, and Ronson soils are moderately deep over sandstone. Some of the cultivated areas are slightly eroded to moderately eroded.

Fertility is low to medium, and the content of organic matter is moderate to moderately low. Available water capacity is low, and these soils are droughty. Surface runoff is medium. Control of soil blowing, conservation of moisture, and the maintenance or improvement of fertility and the content of organic matter are concerns of management. Control of water erosion is also important.

Spring-sown small grains and alfalfa are the main crops. Corn and sorghums are also grown but are damaged by lack of moisture in most years.

Wind stripcropping or contour stripcropping, stubble mulching or use of crop residue, and use of green-manure crops help to control soil blowing and water erosion, to conserve moisture, and to improve fertility and the content of organic matter. Field windbreaks also help to control soil blowing and to conserve moisture.

CAPABILITY UNIT IIIe–12

This unit consists of moderately deep, gently sloping, silty soils of the Huggins series. These soils have a subsoil of silty clay loam and silty clay that is underlain by hard siltstone. Cultivated areas are slightly eroded.

Fertility is medium, and the content of organic matter is moderate. Permeability is moderately slow. A plowpan tends to form in the clayey subsoil below the silty surface. Available water capacity is low, and the soil is somewhat droughty. Surface runoff is medium. Control of water erosion and soil blowing, conservation of moisture, and maintenance of tilth, fertility, and the content of organic matter are concerns of management.

Winter wheat and alfalfa are the main crops. Spring-sown small grains and corn are also grown. Row crops are limited by the low available water capacity, and alfalfa is restricted by the limited root zone.

Contour stripcropping, stubble mulching, chiseling and subsoiling, and use of green-manure crops are practices that help to control water erosion and soil blowing, to conserve moisture, and to maintain tilth, fertility, and the

content of organic matter. The use of terraces is limited by the moderate depth to hard siltstone. A grass cover on natural drainageways helps to prevent the formation of gullies.

CAPABILITY UNIT IIIw-5

In this unit are deep, nearly level, loamy soils of the Wann series. These soils have a fluctuating water table and are on bottom lands and low terraces. The surface layer is sandy loam or loam over fine sandy loam to loamy sand.

These soils are in good tilth. Fertility is medium, and the content of organic matter is moderate. The high water table delays planting in spring and in some years affects crop growth and harvesting. Control of wetness and soil blowing are the main concerns of management. Maintenance of fertility and the content of organic matter are also important.

Spring-sown small grains and alfalfa are the main crops. Corn is grown on the better drained areas.

Drainage systems that include floodways help to regulate the water table and the occasional ponding in low areas. Stubble mulching and the use of green-manure crops help to control soil blowing.

CAPABILITY UNIT IIIs-2

Altvan loam, 0 to 2 percent slopes, is the only soil in this unit. It is moderately deep over gravel.

This soil is in good tilth. Fertility is medium, and the content of organic matter is moderate. Available water capacity is low to moderate, and the soil is droughty. Conservation of moisture is the main concern of management. Other concerns of management are control of soil blowing and maintenance of tilth, fertility, and the content of organic matter.

Small grains and alfalfa are the main crops. Some corn is grown, but this soil is better suited to early-maturing small grains than to corn. Winter wheat alternated with summer fallow is a commonly used cropping system, but the amount of moisture stored during the fallow period is limited by the low to moderate available water capacity.

Stubble mulching, use of grass and legumes in the cropping system, and use of green-manure crops help to conserve moisture, to control soil blowing, and to maintain tilth, fertility, and the content of organic matter.

CAPABILITY UNIT IIIs-3

Millboro silty clay, 0 to 2 percent slopes, is the only soil in this unit. This soil is deep, and slopes are long and uniform. Some of the cultivated areas are slightly eroded.

This soil is medium in fertility and moderate in content or organic matter. It is easily tilled when it is moist, but the soil is very hard when dry. If tilled when wet or too moist, its tilth deteriorates. Available water capacity is moderate to low. Permeability is slow, but the soil cracks when it is dry, aiding water intake until the soil swells and the cracks close. Conservation of moisture, control of soil blowing, and maintenance of tilth and the content of organic matter are concerns of management. Improvement of water intake into the subsoil is also important.

Winter wheat, sorghums, oats, and alfalfa are the main crops. Winter wheat alternated with summer fallow and a sequence of row crops, oats, and alfalfa are the cropping systems commonly used.

Stubble mulching, chiseling and subsoiling, wind stripcropping, and the use of green-manure crops help to conserve moisture, to control soil blowing, to improve water intake, and to maintain tilth, fertility, and the content of organic matter. Contour stripcropping and terracing are beneficial on some of the long slopes.

CAPABILITY UNIT IIIs-5

Huggins silt loam, 0 to 2 percent slopes, is the only soil in this unit. This soil has a subsoil of silty clay loam and silty clay. It is moderately deep over hard siltstone.

Fertility is medium, and content of organic matter is moderate. The soil is easily tilled, but the subsoil is likely to be compacted and form a plowpan. Permeability is moderately slow in the clayey subsoil. Available water capacity is low, and the soil is somewhat droughty. Control of soil blowing, conservation of moisture, and maintenance of tilth, fertility, and the content of organic matter are concerns of management.

Winter wheat and alfalfa are the main crops. Spring-sown small grains and corn are also grown. Row crops are limited by the low available water capacity, and alfalfa is restricted by the limited root zone.

Stubble mulching, chiseling and subsoiling, wind stripcropping, and the use of green-manure crops are practices that help to control soil blowing, to conserve moisture, and to maintain tilth, fertility, and the content of organic matter.

CAPABILITY UNIT IVe-1

This unit consists of moderately deep and deep, strongly sloping, silty soils of the Kadoka and Keith series. Cultivated areas are moderately eroded.

These soils are in good tilth. Fertility is medium, and the content of organic matter is moderate. Permeability is moderate, and available water capacity is moderate to high. Surface runoff is medium. Control of water erosion is difficult in cultivated areas. Other concerns of management are conservation of moisture, control of soil blowing, and maintenance of tilth, fertility, and the content of organic matter.

Most areas of this unit are in native grass and are used for grazing. Winter wheat is the main crop in the few cultivated areas. Spring-sown small grains, alfalfa, and tame grasses are other crops.

Stubble mulching, contour stripcropping, terracing, use of grasses and legumes in the cropping system, and use of green-manure crops help to control water erosion and soil blowing, to conserve moisture, and to maintain tilth, fertility, and the content of organic matter. Grass cover on natural drainageways helps to prevent the formation of gullies.

CAPABILITY UNIT IVe-3

This unit consists of moderately deep, sloping, silty soils of the Huggins series. These soils have a subsoil of silty clay loam or silty clay and are underlain by hard siltstone. Cultivated areas are slightly to moderately eroded.

Fertility is medium, and the content of organic matter is moderate. These soils are easily tilled, but the subsoil is likely to be compacted and form a plowpan. Available water capacity is low, and the soil is somewhat droughty. Permeability is moderately slow, and surface runoff is medium. Control of water erosion and soil blowing, con-

servation of moisture, and maintenance of tilth, fertility, and the content of organic matter are concerns of management.

Most areas are in native grass and are used for grazing. Winter wheat, spring-sown small grains, and alfalfa are the main crops in cultivated areas. Because available water capacity is low, these soils are poorly suited to row crops.

Contour stripcropping, stubble mulching, chiseling and subsoiling, and use of green-manure crops help to control water erosion and soil blowing, to conserve moisture, and to maintain tilth, fertility, and the content of organic matter. The use of terraces is limited by the moderate depth to siltstone. A grass cover on natural drainageways helps to prevent the formation of gullies.

CAPABILITY UNIT IVe–4

This unit consists of deep and moderately deep, sloping, clayey soils of the Millboro and Okreek series. Most slopes are long, but some are short and convex. Cultivated areas are slightly eroded to moderately eroded.

Fertility is medium, and the content of organic matter is moderate. These soils are easily tilled when moist, but they are very hard when dry. Tilth deteriorates if they are tilled when wet or too moist. Available water capacity is moderate to low. Permeability is slow, but the soil cracks when dry, which helps to increase water intake. Surface runoff is medium. Control of erosion is the main concern of management. Other concerns of management are control of soil blowing, conservation of moisture, and maintenance of tilth, fertility, and the content of organic matter.

Winter wheat, sorghums, and alfalfa are the main crops. Crops of winter wheat are alternated with summer fallow.

Contour stripcropping, terracing, stubble mulching, chiseling and subsoiling, and the use of green-manure crops are practices that help to control water erosion and soil blowing, to conserve moisture, and to maintain tilth, fertility, and the content of organic matter. A grass cover on natural drainageways helps to prevent the formation of gullies.

CAPABILITY UNIT IVe–8

This unit consists of deep and moderately deep, undulating or sloping, loamy soils of the Anselmo, Holt, Ronson, and Tuthill series. These soils have a surface layer of fine sandy loam and have a subsoil ranging from loamy sand to clay loam. Holt and Ronson soils are moderately deep over sandstone. Cultivated areas are slightly eroded to moderately eroded.

Fertility is medium to low, and the content of organic matter is moderate to moderately low. Permeability is moderately rapid in all these soils except Tuthill soils. It is moderate in Tuthill soils. Available water capacity is moderate to low in the Anselmo and Tuthill soils and low to very low in the Holt and Ronson soils. Surface runoff is medium. Control of soil blowing and water erosion, conservation of moisture, and maintenance of fertility and the content of organic matter are concerns of management.

Most areas are in native grass. Spring-sown small grains and alfalfa are the main crops in cultivated areas. Corn, sorghums, and tame grasses are also grown.

Contour stripcropping, stubble mulching, and use of green-manure crops help to control soil blowing and water erosion, to conserve moisture, and to maintain fertility and the content of organic matter.

CAPABILITY UNIT IVe–9

This unit consists of deep and moderately deep, nearly level to gently undulating, sandy soils of the Doger, Duda, and Dunday series. Duda soils are moderately deep over sandstone. Cultivated areas are slightly to moderately eroded.

Water enters these soils easily, and moisture is readily released to plants. Fertility is medium to low, and the content of organic matter is moderate to low. Permeability is moderately rapid to rapid, and available water capacity is low to very low. Control of soil blowing is a major concern of management. Other concerns of management are conservation of moisture and maintenance or improvement of fertility and the content of organic matter.

Most areas are in native grass. Spring-sown small grains and alfalfa are the main crops. Some corn is grown on Doger soils.

A suitable cropping system is one that includes alfalfa and tame grasses most of the time. Wind stripcropping, crop residue management, field windbreaks, and use of green-manure crops help to control soil blowing, to conserve moisture, and to improve fertility and the content of organic matter.

CAPABILITY UNIT IVe–10

This unit consists of deep, nearly level, sandy soils of the Elsmere series. These soils are somewhat poorly drained and have a water table within 5 feet of the surface during most of the growing season.

Fertility is medium, and the content of organic matter is moderately low. Permeability is rapid, and available water capacity is low. In some years planting operations are delayed by wetness. Control of soil blowing, conservation of moisture, and maintenance of fertility and the content of organic matter are the main concerns of management.

Most areas are in native grass. Alfalfa and spring-sown small grains are the main crops in cultivated areas. Some corn is also grown.

Stubble mulching, wind stripcropping, and use of green-manure crops help to control soil blowing, to conserve moisture, and to maintain fertility and the content of organic matter.

CAPABILITY UNIT IVe–13

This unit consists of moderately deep and deep, nearly level, loamy soils of the Whitelake and Wortman series. These soils have a surface layer of fine sandy loam over a claypan subsoil.

Permeability is slow to very slow, and the claypan subsoil releases moisture slowly to plants. Available water capacity is moderate to low. Control of soil blowing, conservation of moisture, and improvement of the intake of moisture are major concerns of management. Maintenance of fertility and the content of organic matter are also concerns of management.

Most areas are in native grass. Alfalfa is the main crop in cultivated areas. The soils are also suited to spring-sown small grains.

Alfalfa roots penetrate and help to improve water intake in the subsoil. Returning crop residue to the soil, growing winter cover crops, chiseling and subsoiling, and wind stripcropping on the larger areas help to control soil blowing, to conserve moisture, to improve water intake, and to maintain fertility and the content of organic matter.

CAPABILITY UNIT IVs–2

This unit consists of deep and moderately deep, nearly level to gently sloping soils of the Mosher and Wortman series. These soils have a surface layer of silt loam and a claypan subsoil.

Fertility is medium to low, and the content of organic matter is moderate. Permeability is very slow in the dense claypan subsoil. Available water capacity ranges from low to high, but the claypan subsoil releases moisture slowly to plants. Improvement of water intake into the subsoil and conservation of moisture are major concerns of management. Other concerns of management are control of soil blowing and maintenance or improvement of tilth, fertility, and the content of organic matter.

Many areas are in native grass. Alfalfa and spring-sown small grains are the main crops. Winter wheat alternated with summer fallow is the cropping system in some areas. These soils are not suited to row crops.

Stubble mulching, chiseling and subsoiling, wind stripcropping, use of grass and legumes in the cropping system, and use of green-manure crops help to improve water intake, to conserve moisture, to control soil blowing, and to improve tilth, fertility, and the content of organic matter.

CAPABILITY UNIT Vw–3

In this unit are deep, nearly level, loamy and sandy soils of the Gannett and Loup series and Peaty muck.

The soils in this unit have a high water table and are too wet for cultivated crops. Generally the water table is low enough late in summer to permit haying. The content of organic matter is high. Fires in Peaty muck are difficult to extinguish. Control of the water table level is the main concern of management. Fire prevention is important in Peaty muck.

Nearly all areas are in native grass. Many areas are used for hay meadows.

Where outlets are available, open drains help to control the depth of the water table and to insure accessibility for haying.

CAPABILITY UNIT VIe–1

This unit consists of deep, strongly sloping to hilly, silty soils of the Richfield series. The subsoil is silty clay loam.

Available water capacity is high, and permeability is moderately slow. Surface runoff is medium. Control of erosion and conservation of moisture are the main concerns of management.

All areas are in native grass and are used for grazing. Because of their steep and irregular slopes, these soils are not suited to cultivation. Proper range use helps to control erosion and to conserve moisture.

CAPABILITY UNIT VIe–3

This unit consists of moderately deep, strongly sloping to moderately steep, calcareous, silty soils of the Keota series. Soft siltstone is at a moderate depth.

Permeability is moderate, and available water capacity is low to moderate. Fertility and the content of organic matter are low. Surface runoff is rapid, and erosion is a severe hazard. Gullies form easily in trails and cattle paths. Control of erosion is the main concern of management.

Nearly all areas are in native grass and are used for grazing. The soils are too steep and too erodible for cultivation. Proper use of range helps to control erosion.

CAPABILITY UNIT VIe–4

This unit consists of moderately deep, gently rolling to hilly or moderately steep, clayey soils of the Boyd and Okreek series. Soft shale is at a moderate depth.

Fertility is medium, and the content of organic matter is moderate. Permeability is slow, and available water capacity is low. Surface runoff is medium to rapid, and erosion is a hazard. Control of erosion is the main concern of management.

Nearly all areas are in native grass and are used for grazing. These soils are too steep and too erodible for cultivation.

Seeding cultivated areas with native grass and proper range use in areas in native grass help to control erosion. Water for livestock is provided by ponds that impound surface runoff water.

CAPABILITY UNIT VIe–6

This unit consists of deep and moderately deep, strongly sloping to moderately steep, loamy soils of the Anselmo, Ronson, and Tuthill series. These soils have a surface layer of fine sandy loam.

Fertility is medium to low, and the content of organic matter is moderate to moderately low. Permeability is moderately rapid to moderate, and available water capacity is moderate to low. Surface runoff is medium. Gullies form easily in trails and cattle paths. Sand blowouts form in some of the gullied and eroded areas. Control of water erosion and soil blowing are concerns of management.

Nearly all areas are in native grass and are used for grazing. These soils are too steep and too erodible for cultivation.

Proper range use helps to control water erosion and soil blowing. Wells furnish most of the water for livestock.

CAPABILITY UNIT VIe–7

This unit consists of deep, gently undulating to steep, sandy soils of the Dunday and Valentine series. The surface layer is fine sand or loamy fine sand.

Fertility is low, and the content of organic matter is low or moderately low. Permeability is rapid, and available water capacity is low. Surface runoff is very slow, and most of the rainfall enters the soil. Sand blowouts form easily in areas where livestock concentrate, or where the surface is disturbed. Control of soil blowing is the major concern of management.

Nearly all areas are in native grass and are used for grazing. These soils are too sandy and too erodible for cultivation.

Proper use of range helps to control soil blowing. Water for livestock is provided by shallow wells. Dune stabilization measures help to restore vegetation in sand blowout areas.

CAPABILITY UNIT VIe–10

This unit consists of shallow, sloping to moderately steep, loamy soils of the Tassel series. The surface layer is calcareous fine sandy loam. Soft sandstone is at a depth of about 10 inches.

Fertility and the content of organic matter are low. Available water capacity is very low. Permeability is moderately rapid, and surface runoff is rapid. Control of soil blowing and water erosion are the major concerns of management.

Nearly all areas are in native grass and are used for grazing. This soil is not suitable for cultivation.

Proper use of range helps to control soil blowing and water erosion. Water for livestock is provided by wells because the porous sandstone does not hold water satisfactorily in ponds.

CAPABILITY UNIT VIw–3

Loamy alluvial land and Sandy alluvial land are in this unit. They are mixed soils that formed in alluvium on bottom lands and low terraces and along narrow drainageways. Areas are narrow and are dissected by channels of meandering streams.

These areas are subject to frequent flooding and to the deposition of sediment and debris. The moisture regime favors the growth of tall grasses and trees.

The frequent flooding and the small size of these mapping units make these areas unsatisfactory for cultivation. Most areas are in native vegetation and are used for grazing. A few areas are used for hay. Clumps of trees provide shelter for livestock and wildlife.

CAPABILITY UNIT VIs–1

This unit consists of deep and moderately deep, nearly level to gently sloping, claypan soils of the Hoven, Minatare, and Wanblee series. These soils have a thin silty surface layer over a claypan subsoil.

Runoff is ponded on the Hoven soils and slow to very slow on the Minatare and Wanblee soils. Permeability of the subsoil is very slow to slow, and moisture and plant roots penetrate the claypan with difficulty. Accumulations of salts commonly are near the surface in the Minatare and Wanblee soils.

These soils are not suitable for cultivation. Most areas are in native grass and are used for grazing.

Proper use of range helps to maintain stands of grass, to control soil blowing, and to promote efficient use of moisture. Many of the areas are well suited to dugouts to provide water for livestock.

CAPABILITY UNIT VIs–2

This unit consists of shallow, nearly level to moderately steep, loamy and silty soils of the Canyon, Epping, and Shena series. These soils are over sandstone or siltstone at a depth of less than 20 inches.

These soils are low in fertility and content of organic matter. Available water capacity is very low. These soils are droughty. Surface runoff is medium to rapid. The hazard of erosion is high.

These soils are too shallow for cultivation. Nearly all areas are in native grass and are used for grazing.

Proper use of range helps to maintain stands of grass, to control soil blowing and water erosion, and to promote efficient use of moisture. Water for livestock is provided by impoundments of surface water, but some areas are not suitable for this purpose.

CAPABILITY UNIT VIs–3

This unit consists of shallow, sloping to moderately steep, clayey soils of the Orella and Samsil series. The underlying material is soft shale.

Fertility and the content of organic matter are low. Permeability is slow to very slow, and available water capacity is very low. Surface runoff is rapid, and gullies form in places. Control of erosion is the main concern of management.

These soils are not suitable for cultivation. Nearly all areas are in native grass and are used for grazing.

Proper use of range helps to control erosion. Water for livestock is provided by impoundments of surface water.

CAPABILITY UNIT VIs–4

This unit consists of gently sloping to sloping, loamy soils of the Dix series. These soils are shallow to gravel.

Fertility is low and the content of organic matter is moderately low. Permeability is rapid. Available water capacity is low to very low. These soils are too droughty for cultivation.

Nearly all areas are in native grass and are used for grazing. Proper use of range helps to maintain stands of grass, to conserve soil blowing and water erosion, and to promote efficient use of moisture. Ponds cannot hold water satisfactorily.

CAPABILITY UNIT VIIe–3

This unit consists of moderately deep, steep, calcareous silty soils of the Keota series. Siltstone is at a moderate depth.

Fertility and the content of organic matter are low. Surface runoff is rapid, and gullies form easily. Control of erosion is a major concern of management.

These soils are too steep for cultivation or for haying. All areas are in native grass and are used for grazing. Proper use of range helps to control erosion. These soils are too steep for mechanical treatment.

CAPABILITY UNIT VIIe–4

This unit consists of shallow, steep, loamy soils of the Tassel series. The surface layer is fine sandy loam. Soft sandstone is at a depth of about 10 inches.

Available water capacity is very low, and these soils are droughty. Permeability is moderately rapid, and surface runoff is rapid. Control of soil blowing and water erosion are concerns of management.

These soils are not suitable for cultivation. All areas are in native grass and are used for grazing.

Proper use of range helps to control soil blowing and water erosion. Because the soils are steep, mechanical treatment measures are not feasible.

CAPABILITY UNIT VIIs–2

This unit consists of shallow, steep, clayey soils of the Orella and Samsil series. These soils are underlain by soft shale.

Surface runoff is rapid, and gullies form easily. Control of erosion is the main concern of management.

These soils are not suitable for cultivation or for haying. All areas are in native grass and are used for grazing.

Proper use of range helps to control erosion. These soils are too steep for use of mechanical measures. Water for livestock is provided by impoundments of surface water, but good sites for spillways are scarce.

CAPABILITY UNIT VIIs-4

Only Gravelly land is in this unit. It consists of mixed gravelly soils that are mostly shallow to gravel. It includes areas in which gravel is at or within a few inches of the surface. Slopes are rolling to hilly.

Available water capacity is low or very low, and the areas are droughty. Conservation of moisture and control of erosion are concerns of management.

The areas are not suitable for cultivation or for haying. All areas are in native grass and are used for grazing.

Proper use of range is the best way to conserve moisture and to control erosion. Use of mechanical measures is not feasible on Gravelly land.

CAPABILITY UNIT VIIs-5

Only Saline lowland is in this unit. It consists of mixed saline soils in bottom lands. These soils are mostly sandy and are strongly alkaline.

The water table is at a depth of less than 4 feet and frequently is at the surface. Accumulations of salts are at or near the surface.

These areas are too saline for cultivation. All areas are in native grass and are used for grazing.

Proper use of range helps growth of useful vegetation. Ground-water dugouts and wells are sources of water for livestock.

CAPABILITY UNIT VIIs-6

Only Rough broken land is in this unit. It consists of mixed, steep and very steep soils. Most of these soils are deep and sandy, but some are shallow and loamy or silty. Control of soil blowing and water erosion are the main concerns of management.

All of these areas are in native vegetation, which consists of tall and mid grasses and scattered thin to dense stands of ponderosa pine. Maintaining a good cover of plants helps to control soil blowing and water erosion. Mechanical treatment is not feasible on this land type.

CAPABILITY UNIT VIIIs-1

Only areas of Rock outcrop are in this unit. They consist of sandstone, siltstone, or shale that are bare of vegetation in most places. The areas are suitable mainly for scenery and for recreational purposes, such as searching for agates, artifacts, and fossils.

Yield predictions

Table 2 lists, for each soil in the county judged suitable for crops, the predicted average yields per acre of alfalfa, corn, oats, sorghum, and wheat. The predictions are for dryfarmed soils under two levels of management.

Columns A show yields that can be expected under management that is customarily practiced in the county. Under this level of management, the two most commonly used cropping systems are winter wheat alternated with a period of fallow, and row crops alternated with spring-sown small grains. Alfalfa and tame grasses

TABLE 2.—*Predicted average acre yields of principal crops under two levels of management on soils suited to dryland farming*

Yields in columns A are to be expected under prevailing management; those in columns B, under improved management. Absence of yield indicates the crop is not commonly grown on the soil]

Soil	Alfalfa		Corn		Oats		Sorghum		Winter wheat	
	A	B	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Altvan loam, 0 to 2 percent slopes	0.8	1.2	18	22	24	30	------	------	21	23
Altvan loam, 2 to 5 percent slopes	.6	1.0	13	19	18	25	------	------	15	26
Anselmo fine sandy loam, 2 to 5 percent slopes	1.0	1.3	19	24	30	35	------	------	------	------
Anselmo fine sandy loam, 5 to 9 percent slopes	.8	1.0	16	20	23	30	------	------	------	------
Anselmo-Ronson fine sandy loams, 5 to 9 percent slopes:										
Anselmo soil	.8	1.0	16	20	23	30	------	------	------	------
Ronson soil	.3	.5	5	8	8	12	------	------	------	------
Anselmo-Vetal fine sandy loams, 0 to 2 percent slopes:										
Anselmo soil	1.2	1.5	25	30	32	38	------	------	------	------
Vetal soil	1.4	1.8	35	45	42	50	------	------	------	------
Chappell-Anselmo fine sandy loams, 0 to 3 percent slopes:										
Chappell soil	.8	1.0	17	21	22	26	------	------	------	------
Anselmo soil	1.2	1.5	25	30	32	38	------	------	------	------
Chappell-Anselmo fine sandy loams, 3 to 5 percent slopes:										
Chappell soil	.6	.8	14	19	19	24	------	------	------	------
Anselmo soil	1.0	1.3	19	24	30	35	------	------	------	------
Doger loamy fine sand, 0 to 3 percent slopes	1.1	1.4	13	22	21	30	------	------	------	------
Doger-Dunday loamy fine sands, 3 to 6 percent slopes:										
Doger soil	.8	1.1	------	------	18	25	------	------	------	------
Dunday soil	------	------	------	------	------	------	------	------	------	------
Duda loamy fine sand, 0 to 6 percent slopes	.3	.5	------	------	13	22	------	------	------	------
Dunday loamy fine sand, 0 to 2 percent slopes	.9	1.1	------	------	12	15	------	------	------	------
Dunday fine sandy loam, 0 to 2 percent slopes	1.0	1.3	------	------	15	20	------	------	------	------

465-344—74——5

TABLE 2.—*Predicted average acre yields of principal crops under two levels of management on soils suited to dryland farming*—Continued

Soil	Alfalfa		Corn		Oats		Sorghum		Winter wheat	
	A	B	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Elsmere loamy fine sand, 0 to 3 percent slopes	2.0	2.6			35	43				
Goshen silt loam	1.2	1.6	30	38	37	44	40	45	34	42
Holt fine sandy loam, 0 to 3 percent slopes	1.0	1.3	20	26	25	30	15	20		
Holt-Vetal fine sandy loams, 3 to 9 percent slopes:										
Holt soil	.7	1.0	18	22	22	27	10	15		
Vetal soil	1.3	1.8	34	44	40	48	32	38		
Huggins silt loam, 0 to 2 percent slopes	.8	.9	24	30	35	42			25	30
Huggins-Kadoka silt loams, 2 to 9 percent slopes:										
Huggins soil	.6	.9	17	23	26	31			19	27
Kadoka soil	.7	1.0	19	26	33	39			23	29
Kadoka silt loam, 0 to 2 percent slopes	.9	1.3	25	33	36	42			26	33
Kadoka-Epping silt loams, 5 to 9 percent slopes:										
Kadoka soil	.7	.9	17	24	30	37			22	28
Epping soil										
Kadoka-Huggins silt loams, 2 to 5 percent slopes:										
Kadoka soil	.8	1.1	21	28	34	40			24	30
Huggins soil	.7	.9	18	24	28	34			20	28
Kadoka-Huggins silt loams, 5 to 9 percent slopes:										
Kadoka soil	.7	.9	17	24	30	37			22	28
Huggins soil	.5	.8	15	22	24	32			18	25
Keith silt loam, 0 to 2 percent slopes	1.1	1.5	30	35	39	45			32	40
Keith silt loam, 2 to 9 percent slopes	.9	1.1	24	30	35	42			26	34
Keith-Epping silt loams, 9 to 15 percent slopes:										
Keith soil	.7	.9							18	26
Epping soil										
Keya silt loam	1.2	1.6	35	40	40	45	42	47	35	43
Millboro silty clay, 0 to 2 percent slopes	1.0	1.8	18	24	32	43	35	40	28	36
Millboro silty clay, 2 to 5 percent slopes	.8	1.5	16	22	30	39	33	38	26	34
Millboro silty clay, 5 to 9 percent slopes	.7	1.2	12	18	26	35	29	34	22	30
Mosher silt loam, 0 to 4 percent slopes	.8	1.1							12	18
Okreek silty clay, 5 to 9 percent slopes	.4	.6			22	30	27	32	18	23
Richfield-Dawes silt loams, 0 to 2 percent slopes:										
Richfield soil	1.1	1.5			40	45			33	42
Dawes soil	1.0	1.6			27	32			20	25
Richfield-Tuthill silt loams, 2 to 9 percent slopes:										
Richfield soil	.9	1.1			33	40			26	32
Tuthill soil	.8	1.0			31	38			20	26
Ronson-Anselmo fine sandy loams, 0 to 3 percent slopes:										
Ronson soil	.7	.9	16	20	20	25				
Anselmo soil	1.2	1.5	25	30	32	38				
Ronson-Anselmo fine sandy loams, 3 to 5 percent slopes:										
Ronson soil	.4	.6	10	12	12	15				
Anselmo soil	1.0	1.3	19	24	30	35				
Tuthill silt loam, 0 to 3 percent slopes	1.0	1.4	25	33	37	41			24	31
Tuthill silt loam, 3 to 5 percent slopes	.9	1.1	21	28	32	39			22	28
Tuthill silt loam, 5 to 9 percent slopes	.8	1.0	19	26	31	38			18	25
Tuthill-Anselmo fine sandy loams, 3 to 9 percent slopes:										
Tuthill soil	.8	1.0	19	24	29	36			18	23
Anselmo soil	.8	1.0	17	21	26	33				
Tuthill-Tassel fine sandy loams, 3 to 9 percent slopes:										
Tuthill soil	.8	1.0	19	24	29	36			18	23
Tassel soil										
Tuthill-Vetal fine sandy loams, 0 to 3 percent slopes:										
Tuthill soil	1.1	1.4	26	33	35	45			21	25
Vetal soil	1.4	1.8	35	45	42	50			25	32
Tuthill-Wortman fine sandy loams, 0 to 3 percent slopes:										
Tuthill soil	1.1	1.4	26	33	35	45				
Wortman soil	.5	.7			10	15				
Vetal fine sandy loam	1.4	1.8	35	45	42	50	35	40	25	32
Wann sandy loam	2.0	2.5	35	40	38	43				
Wann loam, depressional	2.2	2.7			35	40				
Whitelake fine sandy loam, 0 to 3 percent slopes	1.0	1.5			25	30				
Wortman fine sandy loam, 0 to 3 percent slopes	.5	.7			10	15				
Wortman silt loam, 0 to 6 percent slopes	.5	.7							8	12

usually remain in a field until the stand fails or becomes unproductive. Farmers apply some practices needed for good management, but they do not apply them in a timely manner or with adequate intensity to meet all the management requirements of a given soil.

Columns B show yields that can be expected under improved management. This management consists of using a cropping system that supplies organic matter and helps to maintain fertility and tilth; applying practices needed to control erosion and to conserve moisture; planting adapted varieties of crops; controlling weeds, insects, and plant diseases; planting, cultivating, and harvesting at the proper time; and adding commercial fertilizer in amounts indicated by soil tests and field trials.

The predicted yields are based on information furnished by farmers and by agricultural specialists familiar with the soils of the county. These predictions were compared with agricultural statistics of the South Dakota Crop and Livestock Reporting Service (*10*).

Management of Tame Pasture [4]

Tame pastures make up a small but important part of the acreage of Todd County. They supplement the grazing afforded by nearby native range. Many tame pastures are grazed too closely during all or part of the grazing season. Close grazing decreases the stand, which results in increased water runoff and exposes the soil to erosion and soil blowing.

Grazing tame pastures in proportion to the amount of forage produced is basic to good management of pasture. The results are best if a pasture is not grazed until the grass grows to a specific height. This height depends on the kinds of tame grass in the pasture. Other practices that improve tame pasture are rotation grazing, clipping to encourage uniform grazing, brush and weed control, use of fertilizer as needed, development of water facilities for livestock, and reseeding with adapted grasses to improve the stand and to increase production.

Sudangrass is grown extensively for temporary summer pastures, but perennial grasses are desirable for permanent pasture plantings. Crested wheatgrass, Russian wildrye, Siberian wheatgrass, and green needlegrass are bunch grasses and are not suited to soils that have slopes of more than 5 percent, unless they are planted with sod-forming grasses. Because of its growth habit, Russian wildrye is not suitable for tame hay.

In the following paragraphs, the soils of Todd County are grouped into pasture suitability groups. Pasture suitability groups G and J are not represented. They are in the statewide system but do not occur in Todd County. Only the soils suited to tame pasture are named. The names of the series represented are mentioned in the description of each group, but this does not mean that all the soils of a given series are in the group. To find the pasture group of any given mapping unit, refer to the "Guide to Mapping Units" at the back of this survey.

PASTURE GROUP A

This group consists of deep, sandy and loamy soils of the Elsmere and Wann series. These soils are on bottom lands. They have a water table that is within 6 feet of the surface during most of the growing season. The abundant moisture supplied by the water table is sufficient to produce 2 to 3 times the amount of vegetation produced by sites on uplands. New growth occurs throughout the grazing season.

Adapted grasses and legumes for these soils are creeping foxtail, crested wheatgrass, intermediate wheatgrass, reed canarygrass, smooth bromegrass, sweetclover, and alfalfa.

PASTURE GROUP B

This group consists of deep, silty soils of the Hoven series and of loamy and sandy soils of the Gannett and Loup series. Hoven soils have a claypan subsoil and are in depressions on uplands. Surface runoff from adjacent soils ponds in these areas. Water stays on the surface of Hoven soils from a few days in some years to as much as several weeks during wet years. Gannett and Loup soils are on bottom lands. Water is at or near the surface of these soils during a part of or all of the growing season.

Reed canarygrass and creeping foxtail are adapted grasses for this site.

PASTURE GROUP C

This group consists of soils of the Mosher and Wortman series. These soils have a surface layer of silt loam and a dense claypan subsoil. Surface runoff is slow to medium, and permeability is very slow. Water and plant roots penetrate the claypan with difficulty, and the claypan releases moisture slowly to plants.

Grasses and legumes suited to the soils of this group are crested wheatgrass, pubescent wheatgrass, Siberian wheatgrass, western wheatgrass, and sweetclover. Alfalfa is also grown on this soil.

PASTURE GROUP D

This group consists of soils of the Altvan and Chappell series. These are loamy soils that are moderately deep over sand and gravel. Available water capacity is low to moderate. These soils are droughty.

Suitable grasses and legumes for these soils are smooth bromegrass, intermediate wheatgrass, crested wheatgrass, pubescent wheatgrass, western wheatgrass, sweetclover, and alfalfa.

PASTURE GROUP E

This group consists of moderately deep to deep silty soils of the Dawes and Huggins series. These soils have a clayey subsoil. The Huggins soils are moderately deep over hard siltstone.

In soils of this group, permeability is moderately slow to slow. Available water capacity is low in the Huggins soils and moderate in the Dawes soil. Root development is restricted in the clayey subsoil of both the Dawes and Huggins soils, and plants are damaged by lack of moisture late in summer.

Suitable grasses and legumes for these soils are crested wheatgrass, intermediate wheatgrass, western wheatgrass, pubescent wheatgrass, sweetclover, and alfalfa.

PASTURE GROUP F

This group consists of moderately deep and deep, silty soils of the Kadoka, Keota, Keith, Richfield, and Tuthill series. The permeability of these soils is moderate to moderately slow. Available water capacity is moderate to

[4] By WALTER N. PARMETER, conservation agronomist, Soil Conservation Service.

high in all these soils except Keota soils. Available water capacity is low to moderate in Keota soils, and fertility is low. Fertility is medium in the other soils of this group. Properties of all these soils are favorable for pasture plants.

Suitable grasses and legumes for these soils are smooth bromegrass, intermediate wheatgrass, crested wheatgrass, western wheatgrass, switchgrass, alfalfa, and sweetclover.

PASTURE GROUP H

This group consists of deep and moderately deep, loamy and sandy soils of the Anselmo, Doger, Duda, Dunday, Holt, Ronson, Tuthill, Vetal, Whitelake, and Wortman series. The surface layer ranges from fine sandy loam to loamy fine sand. Permeability is slow in Whitelake soils, very slow in Wortman soils, and moderate to rapid in all the other soils of this group. Available water capacity is very low to moderate in all the soils of this group. These soils take in moisture very well, and there is very little runoff.

Suitable grasses and legumes for these soils are intermediate wheatgrass, smooth bromegrass, switchgrass, crested wheatgrass, sweetclover, and alfalfa.

PASTURE GROUP I

This group consists of moderately deep and deep, clayey soils of the Boyd, Millboro, and Okreek series. Permeability is slow, but the soil cracks when dry, which aids water intake until the soil swells and the cracks close. Available water capacity is low to moderate. These soils are hard when dry, and the clay in these soils restricts the development of root systems.

Suitable grasses and legumes for these soils are crested wheatgrass, smooth bromegrass, intermediate wheatgrass, pubescent wheatgrass, sweetclover, and alfalfa. The native grasses, western wheatgrass and green needlegrass, are also beneficial in seeding mixtures.

PASTURE GROUP K

This group consists of deep, silty soils of the Goshen and Keya series. These soils are in swales, where they receive additional moisture in the form of runoff from adjacent soils. Permeability is moderate, and available water capacity is high. Soil properties are favorable for producing 1½ to 2 times the forage produced on other sites on uplands.

Suitable grasses and legumes for these soils are intermediate wheatgrass, smooth bromegrass, crested wheatgrass, switchgrass, alfalfa, and sweetclover.

Use of the Soils for Windbreaks [5]

Sparse to moderately dense stands of ponderosa pine are on hilly to steep soils along the Little White River in the northwestern part of the county. Bur oak is an important shorter tree that grows in moderately dense stands where ponderosa pine grows to a height of 65 feet and to a diameter of 24 inches at breast height. Green ash, boxelder, bur oak, American elm, willow, and cottonwood are the main native trees along the principal streams and drainageways. Native woodlands provide protection for livestock and for wildlife. In places native trees are cut for fence posts and firewood. Many areas that have moderately dense stands of merchantable ponderosa pine are in the Timber Reserve of the Rosebud Indian Reservation. All cutting and logging of timber in that area are controlled by the Bureau of Indian Affairs.

Trees and shrubs are planted in Todd County mainly to provide windbreaks that protect crops, livestock, wildlife, and farm buildings, that conserve moisture, and that help to control soil blowing and the drifting of snow (fig. 19). For many of the existing windbreaks supplemental plantings are needed to make them more effective for the purpose for which they were planted.

Farmstead and feedlot windbreaks are narrow belts of trees designed to protect cropland, yards, lots, buildings, and livestock from summer and winter winds, soil blowing, drifting snow, and storm damage. A minimum of seven rows of trees and shrubs is needed to obtain adequate protection so that snow does not accumulate in the area that needs protection.

Field windbreaks are strips or belts of trees and shrubs within or around a field. Their purpose is to help to control soil blowing, to conserve moisture, and to reduce crop damage caused by hot summer winds. Field windbreaks can consist of one row or of multirow plantings. More than five rows generally are not needed to provide the desired protection. The spacing of field windbreaks depends on the susceptibility of the soil to blowing, but 40 rods generally is the maximum. Field windbreaks need to be located far enough from highways and roads to prevent damage from drifting snow.

On sloping soils contour planting of windbreaks helps to control soil erosion and to conserve moisture needed for tree growth.

Windbreak groups

To assist farmers in planning and establishing windbreaks, the soils of Todd County are placed in windbreak groups. These groups are described in the paragraphs that follow. The names of the soil series represented in each group are mentioned in the description of that group, but this does not mean that all soils in the series are in the group. To find the windbreak group for any mapping unit, refer to the "Guide to Mapping Units" at the back of this survey.

WINDBREAK GROUP 1

In this group are deep, silty and loamy soils of the Goshen, Keya, and Vetal series. Surface textures range from silt loam to fine sandy loam. These soils are in swales on uplands. They receive additional moisture in the form of runoff from adjacent soils. Permeability is moderate to moderately rapid. Available water capacity is high, but in Vetal soils it is moderate. All of the soils in this group are favorable for tree growth and have the most favorable moisture regime of all soils in the county for planting trees.

Soils of this group are well suited to the tree plantings for the protection of fields, farmsteads, and feedlots as well as for recreation and wildlife habitat.

WINDBREAK GROUP 2

In this group are deep, sandy and loamy soils of the Elsmere and Wann series. These soils are somewhat

[5] By ELMER L. WORTHINGTON, woodland conservationist, Soil Conservation Service.

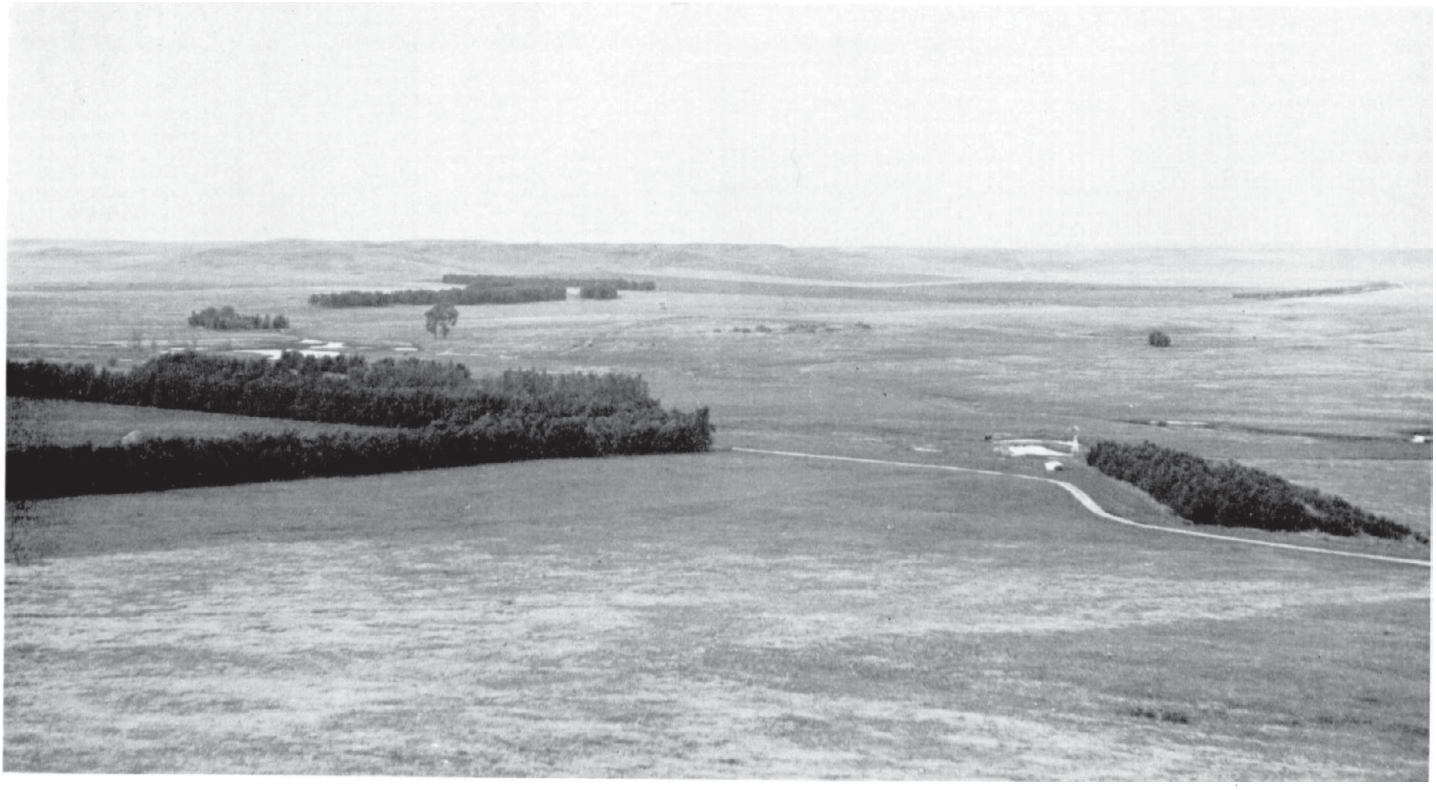


Figure 19.—**Windbreaks used to protect feedlots on Anselmo-Vetal fine sandy loams, 0 to 2 percent slopes. (*Courtesy of the Bureau of Indian Affairs.*)**

poorly drained and the water table is within 6 feet of the surface during most of the growing season. Seasonal rise of the water table interferes with the growth and development of root systems of trees and shrubs.

These soils are well suited to tree plantings for protection of fields, farmsteads, and feedlots, and they are also suitable for use as wildlife habitat and for plantings for recreational purposes. Trees and shrubs suited to the soil and climate grow well because moisture is abundant in the water table. Artificial drainage helps to improve growing conditions for some kinds of plantings. A year of fallow is not needed to prepare the site for planting. Soil blowing is a hazard.

WINDBREAK GROUP 3

In this group are moderately deep and deep, well-drained, silty soils of the Kadoka, Keith, Richfield, and Tuthill series. Permeability is moderate to moderately slow, and available water capacity is moderate to high.

Soils in this group are well suited to all kinds of trees. Sites need to lie fallow for a year preceding planting. Planting on the contour helps to conserve moisture on sloping soils.

WINDBREAK GROUP 4

In this group are moderately deep to deep, well-drained, silty and clayey soils of the Dawes, Huggins, Millboro, and Okreek series. These soils have a subsoil of clay or silty clay that has moderately slow to slow permeability. Available water capacity is low to moderate. The clayey subsoil and the underlying material limit the development of tree roots, especially in the Huggins and Okreek soils. These soils tend to be droughty because runoff and intake of water are slow. Erosion is a hazard on the sloping soils.

Soils of this group are moderately well suited to plantings for windbreaks. They are also suited to plantings for recreation, wildlife habitat, and beautification, but the growth of the plantings can be less than desired. Sites need a fallow period before preparation for planting.

WINDBREAK GROUP 5

In this group are deep and moderately deep, loamy and sandy soils of the Anselmo, Doger, Holt, Tuthill, and Whitelake series. Surface texture is fine sandy loam or loamy fine sand. Permeability is moderate to rapid, but available water capacity is moderate to very low. Soil blowing is a hazard on all the soils in this group and water erosion is a hazard on the sloping soils.

Soils of this group are well suited to tree and shrub planting of all kinds, but practices are needed to help to control soil blowing. Preparation of sites in fall or in spring is satisfactory on these soils. Liberal use of crop residue or cover crops prior to and after planting help to control soil blowing until the trees are tall enough to provide protection.

WINDBREAK GROUP 6

In this group are loamy soils of the Altvan and Chappell series. These soils are moderately deep over sand and gravel. Available water capacity is low to moderate.

These soils are droughty. Because water capacity of the sand and gravel is very low, root system development is shallow.

These soils are poorly suited to windbreak plantings. They are suited to other plantings if optimum growth is not a critical factor. Sites need a fallow period before planting. Contour plantings help to conserve needed moisture.

WINDBREAK GROUP 7

In this group are moderately deep and deep, sandy soils of the Duda, Dunday, and Valentine series. Permeability is rapid to moderately rapid, and available water capacity is low to very low. Fertility and the content of organic matter are low. Soil blowing is a severe hazard.

Soils of this group are poorly suited to windbreak plantings. Where carefully managed, they can be used for plantings for recreation, wildlife habitat, and beautification. Because the surface layer of these soils is unstable, site preparation is not considered desirable. Planting trees in scalp furrows helps to control soil blowing.

WINDBREAK GROUP 8

In this group are moderately deep, calcareous loamy soils of the Ronson series. The surface layer is fine sandy loam. Permeability is moderately rapid, and available water capacity is low. These soils are moderately alkaline, and they are high in content of lime. Fertility is low. Soil blowing is a hazard on these soils.

Soils of this group are moderately well suited to windbreak plantings. Management practices are needed to control and blowing while the site is being prepared.

WINDBREAK GROUP 9

In this group are moderately deep and deep silty soils of the Mosher and Wortman series. These soils have a claypan subsoil that contains sodium. Other salts commonly are in the lower part of the subsoil and in the underlying material. Permeability is very slow in the dense claypan. The claypan and salts make the soils unfavorable for growth of many kinds of trees and shrubs.

Soils of this group are poorly suited to windbreak plantings. They can be used for other kinds of plantings where growth and vigor are less critical.

WINDBREAK GROUP 10

This group consists of soils of the Anselmo, Boyd, Canyon, Dix, Epping, Gannett, Hoven, Keota, Loup, Minatare, Okreek, Orella, Richfield, Ronson, Samsil, Shena, Tassel, and Wanblee series. The land types Gravelly land, Loamy alluvial land, Peaty muck, Rough broken land, Saline lowland, and Sandy alluvial land are also in this group. The areas are too shallow, too steep, too wet, and too saline for establishment of windbreaks that generally are planted by machinery. The soils are suited to plantings for wildlife habitat and for recreation if the trees and shrubs are planted by hand and are given special care. Trees and shrubs suited to soils of this group must be selected on the basis of their tolerance for conditions that prevail at the site proposed for planting.

Windbreak condition

Table 3 shows the condition and height of trees and shrubs at 20 years of age for each windbreak group in the county. The data in this table can be used as a guide in

TABLE 3.—*Condition height of trees and shrubs at*

Condition ratings are defined in the text. An asterisk in the height columns means that values were obtained through measurement; otherwise needed to determine the trees and shrubs to which the soils in this

Trees and shrubs	Group 1		Group 2		Group 3		Group 4	
	Condition	Height	Condition	Height	Condition	Height	Condition	Height
		Ft.		*Ft.*		*Ft.*		*Ft.*
American elm	Good	*23–25	Fair	*18–20	Good	*18–20	Fair	18–20
Black Hills and Colorado blue spruces	Good	20–24	Good	18–20	Fair	*17–19	Poor	
Boxelder	Fair	15–17	Fair	14–16	Fair	*15–17	Poor	
Buffaloberry	Good	6–8	Fair	5–7	Fair	5–7	Good	5–7
Caragana	Good	*8–10	Good	*7–9	Good	*8–9	Good	6–8
Chokecherry	Good	*10–12	Good	8–10	Good	*8–11	Good	8–10
Cotoneaster	Good	4–5	Good	4–5	Good	4–5	Good	4–5
Cottonwood	Fair	30–35	Fair	28–30	Poor		Poor	
Crabapple	Good	12–14	Fair	11–13	Good	*11–13	Fair	10–12
Eastern and Rocky Mountain redcedars	Good	13–15	Good	12–14	Good	*10–12	Good	13–15
Green ash	Good	*18–22	Good	16–18	Good	*14–16	Good	14–16
Hackberry	Good	16–18	Good	12–14	Good	*12–14	Good	12–14
Harbin pear	Good	12–14	Good	10–12	Good	11–13	Fair	9–11
Honeylocust	Good	25–27	Good	20–22	Fair	*18–20	Good	24–26
Honeysuckle	Good	6–8	Fair	5–7	Good	*6–8	Fair	5–7
Lilac	Good	5–6	Fair	4–5	Good	*6–7	Good	4–5
Nanking cherry	Fair	4–5	Fair	4–5	Fair	4–5	Fair	4–5
Ponderosa pine	Good	20–24	Good	16–18	Good	*18–20	Good	15–17
Plum	Good	7–8	Fair	4–5	Good	*7–8	Fair	4–5
Russian-olive	Fair	14–16	Fair	12–14	Fair	*15–17	Fair	12–14
Siberian, dropmore, and Chinkota elms	Good	*25–30	Good	23–27	Good	*24–26	Good	23–25
White and golden willows	Good	28–32	Good	24–26	Poor		Poor	

selecting trees and shrubs that are well suited to soils in each windbreak group. Heights shown in the table are based partly on measurement and partly on estimates of trees and shrubs growing in windbreaks at least 20 years old and that have received adequate care and management. The condition ratings are based on estimated vigor and growth of trees and shrubs in windbreaks at least 20 years old. Criteria for the condition ratings are:

The condition is *good* where—
- Leaves or needles are normal in color and growth.
- The crowns contain only a small amount of dead twigs and branches.
- Damage from insects and diseases and from the effects of climate are limited.
- Evidence of suppression or stagnation is slight.

The condition is *fair* where—
- Leaves and needles are abnormal in color and growth.
- The crowns contain a substantial amount of dead twigs and branches.
- Damage from insects and diseases and from the effects of climate is obvious.
- Evidence of suppression or stagnation is obvious, and the current year's growth is less than normal.

The condition is *poor* where—
- Leaves and needles are very abnormal in color and growth.
- The crowns contain a very large amount of dead twigs and branches.
- Damage from insects and diseases and from the effects of climate is extensive.
- Evidence of severe suppression or stagnation is obvious, and the current year's growth is negligible.

Use of the Soils as Wildlife Habitat [6]

Soils can be managed specifically for wildlife. Production of wildlife can also be a byproduct when soils are managed for other purposes. The availability of food and cover determines the level of production of adapted kinds of wildlife. A specific kind of wildlife can require several kinds of habitat to meet its individual needs. Nesting sites are different from loafing areas, and the vegetation needed for protection can differ from that needed for food. The nature and adequacy of habitat for a specified kind of wildlife are closely related to the plants that can be grown on the soils.

Interpretations of soil suitability for wildlife habitat can be related to the 10 soil associations in Todd County. These 10 associations are grouped into five wildlife areas that differ in potential, species, and environmental factors. In this survey the term "wildlife" refers primarily to game species. The five wildlife areas in Todd County are described in the paragraphs that follow.

WILDLIFE AREA 1

Wildlife area 1 consists of the soils of associations 1, 2, and 9. Most of the upland areas in this group are gently sloping, except for the sides of scattered buttes and ridges and the side slopes of valleys and draws. Significant areas

[6] By JOHN B. FARLEY, biologist, Soil Conservation Service.

20 years of age by windbreak groups of soils

the data were estimated. Heights are not shown for species rated poor. Data are not provided for group 10, because onsite investigation is group are suited. See p. 64 for information on the soils in group 10.]

Group 5		Group 6		Group 7		Group 8		Group 9	
Condition	Height	Condition	Height	Condition	Height	Condition	Height	Condition	Height
	Ft.		*Ft.*		*Ft.*		*Ft.*		*Ft.*
Fair	*18–20	Poor		Poor		Poor		Poor	
Poor		Poor		Poor		Poor		Poor	
Poor		Poor		Poor		Poor		Poor	
Fair	5–6	Poor		Poor		Fair	3–4	Fair	3–4
Good	8–10	Fair	4–5	Poor		Fair	4–5	Fair	4–5
Fair	8–11	Poor		Poor		Poor		Poor	
Good	4–5	Poor		Poor		Poor		Poor	
Poor		Poor		Poor		Poor		Poor	
Fair	11–13	Poor		Poor		Poor		Poor	
Good	*11–13	Fair	7–9	Fair	8–10	Fair	6–8	Fair	5–7
Good	14–16	Fair	9–11	Poor		Fair	8–10	Fair	9–11
Good	*16–18	Fair	11–13	Poor		Poor		Poor	
Good	11–13	Poor		Poor		Fair	4–5	Fair	4–6
Fair	20–22	Fair	11–13	Poor		Poor		Poor	
Fair	4–6	Poor		Poor		Poor		Poor	
Fair	4–5	Fair	3–4	Poor		Fair	3–4	Fair	3–4
Poor		Poor		Poor		Poor		Poor	
Good	18–20	Fair	11–13	Fair	12–14	Fair	12–14	Fair	9–11
Good	5–6	Poor		Poor		Poor		Poor	
Fair	*15–17	Fair	7–9	Poor		Fair	8–9	Fair	8–9
Good	22–24	Fair	11–13	Poor		Fair	10–12	Fair	10–12
Poor		Poor		Poor		Poor		Poor	

of cropland are in association 1. Most of the other areas of soils in this wildlife group are in native grasses, but a few areas of the nearly level and gently sloping soils are used for crops. Native trees and shrubs are along streams and their tributaries as well as in wooded draws.

This wildlife area has good habitat potential for sharp-tailed and pinnated grouse, variable habitat potential for pheasant, moderate habitat potential for deer, and marginal habitat potential for Hungarian partridge. The habitat potential for pheasants is related to management of cropland and to the development of farmstead and field windbreaks (fig. 20). Native woodlands on bottom lands and in draws provide moderate habitat potential for whitetail deer and mule deer. The habitat features are favorable for Hungarian partridge, but the area is in the southern part of the range for this game bird.

WILDLIFE AREA 2

Wildlife area 2 consists of the soils of association 6. The soils of this upland area are gently undulating to steep. They are mostly fine sandy loam and loamy fine sand in texture. Sandstone crops out on the upper parts of sloping escarpments and ridges and on the rims of canyons and draws. Except for scattered tracts of cropland, most of the area is in native grasses. Ponderosa pine grows on some of the steeper slopes. Native deciduous trees and shrubs are on the bottom of canyons and draws.

The native grasses, trees, and shrubs in this wildlife area provide good habitat for deer, particularly mule deer. The habitat potential for wild turkey is also good. Native trees and shrubs provide cover for grouse that come to the area from adjacent grasslands in winter.

WILDLIFE AREA 3

Wildlife area 3 consists of the soils of associations 8 and 10. These associations consist of deep, gently undulating to steep, sandy soils on uplands and of nearly level soils on bottom lands and in low areas where the water table is high. Nearly all of this wildlife area is in native grasses. Some willow and other woody vegetation are on bottom lands.

The soils in this wildlife area are well suited to habitat development for waterfowl, shore birds, grouse, and doves. Some places are suitable for deer and furbearers. Small bodies of open water and marsh in low areas attract waterfowl, shore birds, mourning doves, and muskrat (fig. 21). Woody vegetation on bottom lands provides good habitat for mule deer and whitetail deer. Sharp-tailed grouse are on uplands. The habitat potential for pronghorn antelope is also good, though none are in the area.

WILDLIFE AREA 4

Wildlife area 4 consists of soils in associations 4 and 5. Most of the soils of these upland areas are gently undulating to rolling but a few are nearly level. The native grass cover in this area is interspersed with extensive areas of cropland. Field and farmstead windbreaks provide woody cover, but the lack of native woodland and open water limits the potential of this area for wildlife development.

The mixed grasslands and cropland provide habitat for pheasant, grouse, and mourning doves. Scattered populations of deer are in areas that have field and farmstead windbreaks. Some quail are in the area, but an increase in the population is limited by the climate.

Figure 20.—Single-row tree plantings on Tuthill silt loam, 3 to 5 percent slopes. These trees provide nesting sites for pheasant and songbirds.

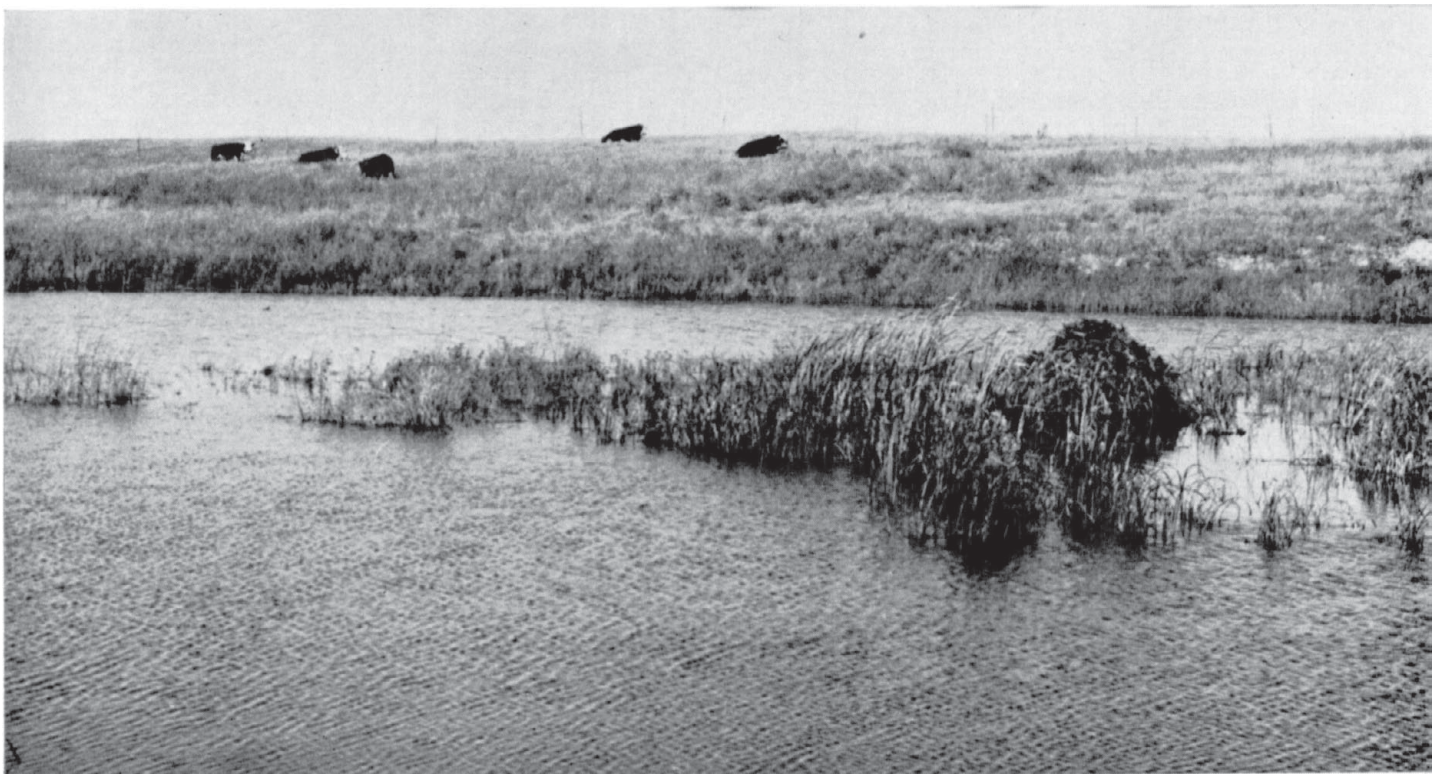


Figure 21.—**Small bodies of open water in association 8 provide habitat for muskrat and breeding areas for waterfowl. (*Courtesy of the Bureau of Indian Affairs.*)**

WILDLIFE AREA 5

Wildlife area 5 consists of soils in associations 3 and 7. Much of this area is steep and Rough broken land. The soils range from shallow to deep and from silty to sandy. Sparse to moderately dense stands of ponderosa pine are intermingled with native grasses. Deciduous trees and shrubs are on bottom lands and in wooded draws.

The habitat potential in this wildlife area is limited mainly to deer. Some potential exists for grouse in the grassy areas. The mixed trees and grass also provide habitat for squirrel, raccoon, and other fauna that prefer such areas. Waterfowl use the few ponds in the area for breeding and nesting. There are some pheasants on the outer edges of the area.

Fishing.—Opportunities to develop sport fisheries are limited in Todd County. Some of the larger bodies of water, such as Beads Lake, Mission Lake, Boarding School Lake, and He Dog Lake, provide fishing and boating facilities. Bass and bluegill are the main kinds of fish in these lakes and in some of the ponds constructed to provide water for livestock. Northern pike are in Boarding School Lake and Mission Lake.

Engineering Uses of the Soils [7]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigations systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

[7] By Gordon Stroup, agricultural engineer, Soil Conservation Service.

465-344—74——6

Most of the information in this section is presented in tables 4, 5, and 6, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 5. It also can be used to make other useful maps.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Estimates generally are made to a depth of about 5 feet, and interpretations do not apply to greater depths. Also, engineers should not apply specific values to the estimates for bearing capacity and traffic-supporting capacity given in this survey. Investigation of each site is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some of the terms used in this soil survey have special

TABLE 4.—*Estimates of soil properties*

[Gravelly land (Gr), Loamy alluvial land (La), Peaty muck (Pm), Rough broken land (Ru), Saline lowland (Sa), and Sandy alluvial land one mapping unit in this series is made up of two or more kinds of soil. For this reason the reader should carefully

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Altvan: AlA, AlB	>5	>5	0–8	Loam	ML or ML–CL	A–4
			8–21	Sandy clay loam	SC or CL	A–6
			21–60	Fine sand and gravel	GC or GM	A–1 or A–2
*Anselmo: AnB, AnC, ArC, AtE, AuE, AvA. For Ronson part of ArC, see Ronson series; for Tassel part of AtE, see Tassel series; for Tuthill part of AuE, see Tuthill series; for Vetal part of AvA, see Vetal series.	>5	>5	0–14	Fine sandy loam	SM	A–2 or A–4
			14–22	Sandy loam	SM or SM–SC	A–2
			22–60	Loamy sand	SM	A–2
*Boyd: BsD For Samsil part, see Samsil series.	2–3½	>5	0–9	Clay	CH	A–7
			9–38	Clay	CH	A–7
			38–60	Shale.		
Canyon: Mapped only with Richfield soils.	½–1½	>5	0–12	Loam	ML	A–4
			12–30	Sandstone.		
*Chappell: CaA, CaB For Anselmo part, see Anselmo series.	>5	>5	0–15	Sandy loam	SM	A–2 or A–4
			15–22	Loamy sand	SM	A–2
			22–60	Sand and gravel	GM or GC	A–1
Dawes: Mapped only with Richfield soils.	>3½	>5	0–9	Silt loam	ML or CL	A–4 or A–6
			9–18	Silty clay	CH or CL	A–7
			18–40	Silt loam	ML or CL	A–6 or A–4
			40–60	Sandstone.		
*Dix: DcC For Chappell part, see Chappell series.	>5	>5	0–14	Sandy loam	SM	A–2 or A–4
			14–60	Sand and gravel	SP–SM or GM	A–1 or A–2
*Doger: DfA, DgB For Dunday part of DgB, see Dunday series.	>5	>5	0–26	Loamy fine sand	SM	A–2 or A–4
			26–60	Fine sand	SM	A–2
Duda: DlB	1½–3½	>5	0–8	Loamy fine sand	SM	A–2 or A–4
			8–25	Loamy sand	SM	A–2
			25–60	Sandstone.		
Dunday: DsA, DuA	>5	>5	0–13	Loamy fine sand	SM	A–2 or A–4
			13–22	Loamy fine sand	SM	A–2
			22–60	Fine sand	SM	A–2
Elsmere: ElA	>5	2–6	0–15	Loamy fine sand	SM	A–2 or A–4
			15–60	Loamy fine sand	SM	A–2

meaning to soil scientists not known to all engineers. Many of the terms commonly used in soil science are defined in the Glossary at the back of this survey.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*14*) used by the SCS engineers, Department of Defense, and other agencies, and the AASHO system (*2*) developed by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing

significant to engineering

(Sd) are omitted from table because their properties are too variable for estimating. An asterisk in the first column indicates that at least follow the instructions for referring to other series in the first column of this table. >=more than; <=less than]

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*				
95–100	90–100	85–95	60–75	1. 20–2. 00	0. 18–0. 20	6. 6–7. 8	None	Low	Moderate	Low.
95–100	90–100	80–90	35–55	0. 60–1. 20	0. 16–0. 18	6. 6–8. 4	None	Moderate	Moderate	Low.
50–75	40–60	20–50	10–35	>6. 00	0. 03–0. 06	7. 9–8. 4	None	Low	Low	Low.
100	100	70–95	30–40	2. 00–6. 00	0. 14–0. 17	6. 6–7. 3	None	Low	Low	Low.
100	100	80–95	25–35	2. 00–6. 00	0. 09–0. 13	6. 6–7. 3	None	Low	Low	Low.
100	100	60–100	20–30	>6. 00	0. 08–0. 10	6. 6–7. 3	None	Low	Low	Low.
100	100	95–100	85–100	0. 06–0. 20	0. 10–0. 14	6. 6–8. 4	None	High	High	Low.
100	100	95–100	90–100	0. 06–0. 20	0. 08–0. 10	7. 9 8. 4	Low	High	High	Moderate.
90–100	85–100	70–95	50–70	1. 20–2. 00	0. 17–0. 19	7. 9–8. 4	None	Low	Moderate	Low.
100	95–100	60–80	30–40	2. 00–6. 00	0. 11–0. 15	6. 6–7. 3	None	Low	Low	Low.
100	95–100	50–75	25–30	2. 00–6. 00	0. 08–0. 10	7. 9–8. 4	None	Low	Low	Low.
50–70	40–60	15–40	5–15	>6. 00	0. 03–0. 06	7. 9–8. 4	None	Low	Low	Low.
100	100	90–100	90–100	0. 60–1. 20	0. 19–0. 22	6. 6–7. 3	None	Low	High	Low.
100	100	95–100	90–95	0. 06–0. 20	0. 11–0. 16	7. 3–8. 4	None	Moderate	High	Low.
100	90–100	90–100	70–90	0. 60–2. 00	0. 17–0. 20	7. 9–8. 4	Low	Low	High	Low.
90–100	85–100	60–70	25–50	2. 00–6. 00	0. 11–0. 15	6. 6–8. 4	None	Low	Low	Low.
40–65	40–60	20–40	5–15	>6. 00	0. 03–0. 06	7. 9–8. 4	None	Low	Low	Low.
100	100	65–90	25–40	>6. 00	0. 10–0. 12	6. 1–7. 3	None	Low	Low	Moderate.
100	100	65–80	20–35	>6. 00	0. 06–0. 08	6. 6–7. 3	None	Low	Low	Low.
100	100	65–90	25–40	2. 00–6. 00	0. 10–0. 12	6. 1–6. 5	None	Low	Low	Moderate.
100	95–100	50–75	10–20	2. 00–6. 00	0. 08–0. 10	6. 6–7. 3	None	Low	Low	Low.
100	95–100	65–90	30–40	2. 00–6. 00	0. 10–0. 12	6. 6–7. 3	None	Low	Low	Low.
100	95–100	65–90	20–35	>6. 00	0. 08–0. 10	6. 6–7. 3	None	Low	Low	Low.
100	95–100	65–80	20–35	>6. 00	0. 06–0. 08	7. 4–7. 8	None	Low	Low	Low.
100	100	65–90	30–45	2. 00–6. 00	0. 10–0. 12	7. 4–7. 8	None	Low	Low	Low.
100	95–100	65–90	20–35	>6. 00	0. 08–0. 10	7. 4–8. 4	Low	Low	Low	Low.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Epping Mapped only with Kadoka, Keith, and Keota soils.	½–1½	>5	0–7 7–50	Silt loam Siltstone.	ML	A–4
Gannett: Ge	>5	0–2	5–0 0–10 10–60	Peat Sandy loam Fine sand	OH or OL SM or SM–SC SM	 A–2 or A–4 A–2
Goshen: Gh	>5	>5	0–11 11–38 38–60	Silt loam Silty clay loam Silt loam	ML–CL or CL CL ML–CL or CL	A–4 or A–6 A–7 A–4 or A–6
*Holt: HfA, HIC For Vetal part of HIC, see Vetal series.	2–3½	>5	0–11 11–22 22–60	Fine sandy loam Sandy loam Sandstone.	SM SM or SM–SC	A–4 or A–2 A–2
Hoven: HmA, HnA	>5	>5	0–6 6–16 16–26 26–60	Silt loam Clay Clay loam Sandy clay loam	ML or ML-CL CH CL or CH SC or CL	A–4 A–7 A–6 or A–7 A–6 or A–7
*Huggins: HuA, HwB For Kadoka part of HwB, see Kadoka series.	1½–2½	>5	0–5 5–21 21–26 26–60	Silt loam Silty clay Gravelly clay loam Siltstone.	ML or CL CH or MH SC or CL	A–4 or A–6 A–7 A–2, A–4, or A–6
*Kadoka: KaA, KbC, KdB, KdC For Epping part of KbC, see Epping series; for Huggins part of KdB and KdC, see Huggins series.	2–3½	>5	0–4 4–18 18–38 38–60	Silt loam Silty clay loam Silt loam Siltstone.	ML or ML-CL ML-CL or CL ML or ML-CL	A–4 or A–6 A–6 or A–7 A–4
*Keith, KeA, KeC, KgD For Epping part of KgD, see Epping series.	>3½	>5	0–5 5–16 16–60	Silt loam Silty clay loam Silt loam	ML or CL CL ML or CL	A–4 or A–6 A–7 A–4 or A–6
*Keota: KhE, KkD, KrF For Epping part of KhE, see Epping series; for Kadoka part of KkD, see Kadoka series.	1½–3½	>5	0–31 31–60	Silt loam Siltstone.	ML	A–4
Keya: Ky	>5	>5	0–19 19–38 38–44 44–60	Silt loam Clay loam Loam Fine sandy loam	ML or CL CL ML SM or ML	A–4 or A–6 A–7 A–4 A–2 or A–4
*Loup: Le For Elsmere part, see Elsmere series.	>5	1–3	0–15 15–60	Loamy sand Fine sand	SM SM	A–2 A–2
Millboro: MbA, MbB, MbC	>3½	>5	0–5 5–38 38–60	Silty clay Clay Silty clay	CH CH CH or CL	A–7 A–7 A–7
Minatare: Mapped only in complex with Mosher soils.	>5	>5	0–3 3–11 11–33 33–60	Silt loam Clay Silty clay loam Very fine sandy loam	ML or ML-CL CH CL ML	A–4 A–7 A–6 or A–7 A–4
*Mosher: MhA, MmA For Minatare part of MmA, see Minatare series.	>3½	3–7	0–7 7–17 17–60	Silt loam Clay loam Stratified clay loam, sand and gravel.	ML or ML-CL MH or CH CL or SC	A–4 A–7 A–6 or A–4

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*				
90–100	90–100	85–100	70–90	0. 60–1. 20	0. 17–0. 20	7. 9–8. 4	None	Low	High	Low.
100	100	60–70	30–40	2. 00–6. 00	0. 11–0. 15	7. 4–7. 8	None	Low	High	Moderate.
100	100	65–80	15–30	>6. 00	0. 06–0. 08		None	Low	High	Moderate.
100	100	90–100	75–95	0. 60–2. 00	0. 19–0. 22	7. 4–7. 8	None	Moderate	High	Low.
100	100	95–100	85–95	0. 60–1. 20	0. 19–0. 22	7. 4–7. 8	None	Moderate	High	Low.
100	100	90–100	70–90	0. 60–2. 00	0. 17–0. 20	7. 4–8. 4	None	Moderate	High	Low.
100	100	70–100	30–50	2. 00–6. 00	0. 14–0. 17	6. 6–7. 8	None	Low	Low	Low.
90–100	90–100	60–90	25–35	2. 00–6. 00	0. 09–0. 13	7. 4–7. 8	None	Low	Low	Low.
100	100	90–100	70–90	0. 60–2. 00	0. 19–0. 22	6. 6–7. 3	None	Low	High	Low.
100	100	90–100	75–95	<0. 06	0. 10–0. 15	7. 4–7. 8	Low	High	High	Moderate.
100	100	90–100	70–80	0. 20–0. 60	0. 14–0. 17	7. 4–7. 8	Low	Moderate	High	Moderate.
100	95–100	80–90	40–55	0. 20–0. 60	0. 16–0. 18	6. 6–8. 4	Low	Moderate	High	High.
100	100	90–100	70–90	0. 60–1. 20	0. 19–0. 22	6. 6–7. 3	None	Low	Moderate	Low.
90–100	90–100	90–100	70–95	0. 20–0. 60	0. 11–0. 16	7. 4–7. 8	None	High	High	Low.
50–85	50–85	45–85	30–60	0. 20–0. 60	0. 09–0. 16	7. 4–7. 8	None	Moderate	High	Low.
100	100	90–100	70–90	0. 60–2. 00	0. 19–0. 22	6. 6–7. 3	None	Low	Low	Low.
100	90–100	90–100	85–95	0. 60–1. 20	0. 17–0. 20	6. 6–7. 8	None	Moderate	Moderate	Low.
100	90–100	85–100	70–90	0. 60–2. 00	0. 17–0. 20	7. 9–8. 4	None	Low	Moderate	Low.
100	100	90–100	70–90	0. 60–2. 00	0. 19–0. 22	6. 6–7. 3	None	Low	Moderate	Low.
100	100	95–100	85–95	0. 60–1. 20	0. 19–0. 22	7. 4–7. 8	None	Moderate	Moderate	Low.
100	100	90–100	70–90	0. 60–2. 00	0. 17–0. 20	7. 9–9. 0	None	Low	Moderate	Low.
95–100	95–100	90–100	80–95	0. 60–2. 00	0. 17–0. 30	8. 5–9. 0	Low	Low	Moderate	Low.
100	100	90–100	70–90	0. 60–2. 00	0. 19–0. 22	6. 6–7. 3	None	Low	Moderate	Low.
100	100	90–100	70–80	0. 60–1. 20	0. 19–0. 22	7. 4–7. 8	None	Moderate	High	Low.
100	100	85–95	60–75	1. 20–2. 00	0. 16–0. 18	7. 4–7. 8	None	Low	Moderate	Low.
100	100	70–85	30–55	2. 00–6. 00	0. 12–0. 15	7. 4–7. 8	None	Low	Moderate	Low.
100	100	50–75	15–35	>6. 00	0. 10–0. 12	6. 6–7. 8	None	Low	High	Moderate.
100	100	65–80	15–20	>6. 00	0. 06–0. 08	6. 6–7. 3	None	Low	High	Moderate.
100	100	95–100	90–95	0. 20–0. 60	0. 13–0. 18	7. 4–7. 8	None	High	High	Low.
100	100	90–100	75–95	0. 06–0. 20	0. 08–0. 12	7. 4–8. 4	None	High	High	Moderate.
100	100	95–100	85–95	0. 06–0. 20	0. 11–0. 16	7. 9–8. 4	Low	High	High	Moderate.
100	100	90–100	70–90	0. 60–2. 00	0. 17–0. 20	6. 6–7. 3	None	Low	High	Low.
100	100	90–100	75–95	<0. 06	0. 08–0. 13	7. 9–9. 0	Low	High	High	High.
100	100	95–100	85–95	0. 20–0. 60	0. 14–0. 17	8. 5–9. 0	Moderate	Moderate	High	High.
100	95–100	85–95	50–75	1. 20–2. 00	0. 14–0. 17	7. 9–8. 4	Low	Low	High	Moderate.
100	100	90–100	70–90	0. 60–2. 00	0. 19–0. 22	6. 6–7. 3	None	Low	Low	Low.
100	100	90–100	70–80	<0. 06	0. 11–0. 14	7. 9–8. 4	Low	High	High	Moderate.
85–100	85–100	70–100	40–55	0. 20–2. 00	0. 12–0. 20	7. 9–8. 4	Moderate	Low	High	Moderate.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
*Okreek: OkC, OoE	2–3½	>5	0–5	Silty clay	CH	A–7
			5–38	Clay	CH	A–7
For Orella part of OoE, see Orella series.			38–60	Shale.		
Orella: OrF	½–1½	>5	0–10	Clay	CH	A–7
			10–60	Shale.		
*Richfield: RcE, RdA, RhB	>3½	>5	0–9	Silt loam	ML or CL	A–4 or A–6
			9–30	Silty clay loam	CL	A–7
For Canyon part of RcE, see Canyon series; for Dawes part of RdA, see Dawes series; for Tuthill part of RhB, see Tuthill series.			30–50	Silt loam	ML or ML–CL	A–4 or A–6
			50–60	Sandstone.		
*Ronson: RnA, RnB	1½–3½	>5	0–12	Fine sandy loam	SM	A–4 or A–2
			12–35	Sandy loam	SM	A–2
For Anselmo part, see Anselmo series.			35–60	Sandstone.		
*Samsil: SbE	½–1½	>5	0–13	Clay	CH	A–7
			13–60	Shale.		
For Boyd part, see Boyd series.						
Shena: SnC	½–1½	>5	0–4	Silt loam	ML or ML–CL	A–4 or A–6
			4–12	Silty clay	CL, MH, or CH	A–7
			12–60	Siltstone.		
*Tassel: TcF, TfE	½–1½	>5	0–10	Sandy loam	SM	A–2 or A–4
			10–60	Sandstone.		
For Ronson part of TfE, see Ronson series.						
*Tuthill: ThA, ThB, ThC, TnC, TtC, TvA, TwA.	>3½	>5	0–9	Fine sandy loam	SM or ML	A–2 or A–4
			9–29	Sandy clay loam	SC or CL	A–6
For Anselmo part of TnC, see Anselmo series; for Tassel part of TtC, see Tassel series; for Vetal part of TvA, see Vetal series; for Wortman part of TwA, see Wortman series.			29–60	Loamy sand	SM	A–2
* Valentine: VaE, VdC, VsE	>5	>5	0–60	Fine sand	SM or SP–SM	A–2 or A–3
For Dunday part of VdC, see Dunday series; for Tassel part of VsE, see Tassel series.						
Vetal: Vt	>3½	>5	0–44	Sandy loam	SM	A–4
			44–60	Loamy sand	SM	A–2
* Wanblee: WbA	1½–3	>5	0–5	Clay	CH or MH	A–7
			5–22	Loam	CL or ML	A–6 or A–4
For Wortman part, see Wortman series.			22–60	Siltstone.		
Wann: Wd, We	>5	3–6	0–9	Fine sandy loam	SM	A–4
			9–54	Fine sandy loam	SM	A–2 or A–4
			54–60	Loamy sand	SM	A–2
Whitelake: WhA	>3½	4–6	0–17	Fine sandy loam	SM	A–4
			17–22	Fine sandy loam	SM–SC or ML–CL	A–4
			22–60	Sandy loam	SM	A–2
Wortman: WoA, WrA	1½–3½	>5	0–8	Silt loam	ML	A–4
			8–15	Clay	CH, MH, or CL	A–7
			15–34	Loam	ML or CL	A–4 or A–6
			34–60	Siltstone.		

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*				
100	100	90–100	90–95	0. 20–0. 60	0. 13–0. 18	6. 6–7. 3	None	High	High	Low.
100	100	90–100	90–100	0. 06–0. 20	0. 08–0. 12	7. 4–8. 4	Low	High	High	Moderate.
100	100	90–100	80–95	<0. 06	0. 08–0. 12	7. 4–8. 4	Low	High	High	Moderate.
100	100	90–100	80–90	0. 60–1. 20	0. 19–0. 22	7. 4–7. 8	None	Low	Moderate	Low.
100	100	95–100	85–95	0. 20–0. 60	0. 14–0. 17	7. 9–8. 4	None	Moderate	Moderate	Low.
100	95–100	90–100	70–90	0. 60–1. 20	0. 17–0. 20	7. 9–8. 4	None	Low	Moderate	Low.
100	100	70–85	25–45	2. 00–6. 00	0. 14–0. 17	7. 9–8. 4	None	Low	Low	Low.
90–100	85–100	60–70	15–35	2. 00–6. 00	0. 09–0. 13	7. 9–8. 4	None	Low	Low	Low.
100	95–100	80–100	75–95	0. 06–0. 20	0. 08–0. 12	7. 4–8. 4	Low	High	High	Moderate.
100	100	90–100	75–95	0. 60–1. 20	0. 19–0. 22	6. 6–7. 3	None	Low	High	Low.
90–100	90–100	80–100	75–95	0. 20–0. 60	0. 13–0. 18	6. 6–7. 3	None	High	High	Low.
95–100	80–100	60–70	25–45	2. 00–6. 00	0. 09–0. 13	7. 9–8. 4	None	Low	Low	Low.
100	100	70–85	30–55	2. 00–6. 00	0. 14–0. 17	6. 6–7. 3	None	Low	Low	Low.
100	100	80–90	40–70	0. 60–1. 20	0. 16–0. 18	6. 6–7. 3	None	Moderate	Moderate	Low.
100	95–100	50–75	15–35	>6. 00	0. 08–0. 10	7. 4–8. 4	None	Low	Low	Low.
100	100	65–95	5–20	>6. 00	0. 06–0. 08	6. 6–7. 3	None	Low	Low	Low.
100	100	60–70	35–45	2. 00–6. 00	0. 11–0. 15	6. 6–7. 8	None	Low	Low	Low.
100	100	50–75	20–30	>6. 00	0. 08–0. 10	7. 4–7. 8	None	Low	Low	Low.
100	100	90–100	70–85	0. 06–0. 20	0. 08–0. 13	7. 9–9. 0	Moderate	High	High	High.
100	95–100	85–95	55–75	0. 60–1. 20	0. 16–0. 18	8. 5–9. 0	Low	Moderate	High	High.
100	100	70–85	35–50	2. 00–6. 00	0. 14–0. 17	6. 6–7. 3	None	Low	Moderate	Low.
100	100	70–85	25–50	2. 00–6. 00	0. 12–0. 15	7. 4–8. 4	Low	Low	Moderate	Low.
100	100	50–75	20–30	>6. 00	0. 08–0. 10	7. 9–8. 4	None	Low	Moderate	Low.
100	100	70–85	35–50	2. 00–6. 00	0. 14–0. 17	6. 6–7. 3	None	Low	Low	Low.
100	100	70–85	40–55	0. 06–0. 20	0. 09–0. 12	7. 4–8. 4	Low	Moderate	Moderate	Moderate.
100	95–100	60–70	20–35	2. 00–6. 00	0. 09–0. 13	8. 5–9. 0	None	Low	High	Moderate.
100	100	90–100	80–90	0. 60–2. 00	0. 19–0. 22	6. 6–7. 3	None	Low	High	Low.
100	100	90–100	90–100	<0. 06	0. 08–0. 13	7. 4–8. 4	Low	High	High	Moderate.
95–100	95–100	85–95	75–85	0. 60–1. 20	0. 13–0. 15	8. 5–9. 0	Moderate	Low	High	Moderate.

TABLE 5.—*Interpretations*

[Gravelly land (Gr), Loamy alluvial land (La), Peaty muck (Pm), Rough broken land (Ru), Saline lowland (Sa), and Sandy alluvial land in the series is made up of two or more kinds of soil. For this reason the reader should

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank filter fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfills [1]	Local roads and streets
Altvan: AlA, AlB	Slight [2]	Severe: rapid permeability below depth of 2 feet.	Severe: sloughing below depth of 2 feet; sand and gravel substratum.	Moderate: moderate shrink-swell potential in subsoil.	Severe: rapid permeability below depth of 2 feet; good cover material in upper 2 feet.	Moderate: moderate shrink-swell potential in subsoil.
*Anselmo: AnB, AnC, ArC, AtE, AuE, AvA. For Ronson part of ArC, see Ronson series; for Tassel part of AtE, see Tassel series; for Tuthill part of AuE, see Tuthill series; for Vetal part of AvA, see Vetal series.	Slight to moderate where slope is less than 15 percent; severe where slope is more than 15 percent.	Severe: moderately rapid permeability.	Severe: loamy sand substratum.	Slight to moderate where slope is less than 15 percent; severe where slope is more than 15 percent.	Severe: moderately rapid permeability.	Slight to moderate where slope is less than 15 percent; severe where slope is more than 15 percent.
*Boyd: BsD For Samsil part, see Samsil series.	Severe: slow permeability.	Severe: shale at depth of less than 40 inches.	Severe: clayey	Severe: high shrink-swell potential.	Severe: difficult to work; clay.	Severe: high shrink-swell potential.
Canyon Mapped only with Richfield soils.	Severe: slopes; hardness of sandstone variable.	Severe: porous sandstone at shallow depth.	Severe: slopes; hardness of sandstone variable.	Severe: slopes; hardness of sandstone variable.	Moderate: slopes; sandstone generally rippable; poor cover material.	Severe: slopes; sandstone rippable.
*Chappell: CaA, CaB For Anselmo part, see Anselmo series.	Slight [2]	Severe: rapid permeability below depth of 2 feet.	Severe: sloughing below depth of 2 feet; sand and gravel substratum.	Slight	Severe: rapid permeability below depth of 2 feet.	Slight
Dawes Mapped only with Richfield soils.	Severe: slow permeability.	Slight	Moderate: silty clay subsoil; sandstone substratum.	Moderate: moderate shrink-swell potential.	Moderate: soft sandstone below depth of 40 inches.	Moderate: moderate shrink-swell potential.
*Dix: DcC For Chappell part, see Chappell series.	Slight [2]	Severe: rapid permeability.	Severe: sloughing; sand and gravel substratum.	Slight	Severe: rapid permeability; poor cover material.	Slight
*Doger: DfA, DgB For Dunday part of DgB, see Dunday series.	Slight [2]	Severe: rapid permeability.	Severe: sloughing; fine sand texture.	Slight	Severe: rapid permeability.	Slight
Duda: DlB	Severe: sandstone at depth of 20 to 40 inches.	Severe: moderately rapid permeability; sandstone at depth of 20 to 40 inches.	Severe: sloughing; loamy sand texture; sandstone at depth of 20 to 40 inches.	Moderate: sandstone at depth of 20 to 40 inches.	Severe: moderately rapid permeability; poor cover material.	Slight: sandstone is rippable.
Dunday: DsA, DuA	Slight [2]	Severe: rapid permeability.	Severe: sloughing; sandy texture.	Slight	Severe: rapid permeability; poor cover material.	Slight

See footnotes at end of table.

of engineering properties

(Sd) are omitted from table because their properties are variable. An asterisk in the first column indicates that at least one mapping unit carefully follow the instructions for referring to another series in the first column of this table]

Suitability as source of—			Soil features affecting—					
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Fair to depth of 2 feet; good below depth of 2 feet.	Poor: more than 12 percent fines or plastic.	Fair: 8 to 16 inches thick.	Rapid permeability below depth of 2 feet.	Fair to good stability.	Sand and gravel substratum at depth of 20 to 40 inches.	Low to moderate available water capacity; moderate intake rate; gravel at depth of 20 to 40 inches.	Gravel below depth of 2 feet.	Cuts expose gravel.
Good where slope is less than 15 percent.	Poor: more than 12 percent fines.	Fair: subject to soil blowing.	Moderately rapid permeability.	Good stability; fair to good compaction; slight compressibility; possible piping.	Loamy sand substratum.	Low to moderate available water capacity; subject to soil blowing; moderately rapid intake rate.	Moderately rapid permeability; subject to soil blowing.	Highly erodible.
Poor: high shrink-swell potential.	Not suited	Poor: clayey	Shale at depth of less than 40 inches.	Unstable; high shrink-swell potential; low shear strength.	Slow permeability; shale at depth of 20 to 40 inches.	Shale at a depth of 20 to 40 inches.	Shale at depth of less than 40 inches; slow permeability.	Highly erodible.
Poor: slopes	Not suited	Poor: thin surface layer; low fertility.	Fractured soft sandstone; high seepage potential.	Shallow to soft sandstone.	Sandstone at depth of less than 20 inches.	Slopes; sandstone at shallow depth.	Soft sandstone at shallow depth.	Not applicable.
Good	Poor: more than 12 percent fines or plastic.	Fair: subject to soil blowing.	Rapid permeability below depth of 2 feet.	Good stability; fair to good compaction; pipes.	Sand and gravel substratum at depth of 20 to 40 inches.	Law available water capacity; rapid intake rate.	Gravel below depth of 2 feet.	Cuts expose gravel.
Poor: moderate shrink-swell potential.	Not suited	Fair: 8 to 16 inches thick.	Soft sandstone below depth of 40 inches in places.	Fair to poor stability.	Slow permeability.	Slow intake rate; slow permeability; moderate available water capacity.	Slow permeability.	Clayey subsoil.
Good	Fair to poor: more than 12 percent fines or plastic.	Poor: thin surface layer; low fertility.	Rapid permeability.	Good stability; fair to good compaction; pipes.	Sand and gravel substratum at depth of less than 20 inches.	Very low to low available water capacity; rapid permeability; rapid intake rate.	Gravel at shallow depth.	Gravel at shallow depth.
Good	Poor: more than 12 percent fines.	Poor: sandy	Too porous to hold water; rapid permeability.	Good stability; fair to good compaction; pipes.	Sandy texture; rapid permeability.	Low to moderate available water capacity; very rapid intake rate; subject to soil blowing.	Rapid permeability; subject to soil blowing.	Highly erodible.
Good: sandstone generally rippable.	Not suited	Poor: blows easily; sandy.	Too porous to hold water; moderately rapid permeability.	Good stability; fair to good compaction; pipes.	Sandstone at depth of 20 to 40 inches.	Very low available water capacity; very rapid intake rate.	Sandstone at depth of 20 to 40 inches.	Highly erodible; cuts expose sandstone.
Good	Poor: more than 12 percent fines.	Poor: blows easily.	Too porous to hold water; rapid permeability.	Good stability; fair to good compaction; pipes.	Sandy texture; rapid permeability.	Low available water capacity; very rapid intake rate; subject to soil blowing.	Rapid permeability; subject to soil blowing.	Highly erodible.

TABLE 5.—*Interpretations*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank filter fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfills [1]	Local roads and streets
Elsmere: EIA	Severe: water table.	Severe: rapid permeability; water table.	Severe: sloughing; water table.	Moderate to severe: water table.	Severe: rapid permeability; water table.	Moderate: somewhat poorly drained.
Epping: Mapped only with Kadoka, Keith, and Keota soils.	Severe: siltstone; at shallow depth; slopes.	Severe: siltstone at shallow depth.	Moderate: siltstone at shallow depth.	Moderate to severe: slopes; siltstone generally rippable.	Moderate: siltstone rippable; poor cover material.	Moderate to severe: slopes; siltstone generally rippable.
Gannett: Ge	Severe: water table.	Severe: water table.	Severe: water table.	Severe: water table.	Severe: water table.	Severe: very poorly drained.
Goshen: Gh	Moderate to severe: moderate permeability; run-in water in places.	Moderate: moderate permeability; severe if unprotected from run-in water.	Moderate to severe: moderately well drained; run-in water in places.	Moderate to severe: moderate shrink-swell potential; run-in water in places.	Moderate to severe: run-in water in places.	Moderate: moderate shrink-swell potential.
*Holt: HfA, HIC For Vetal part of HIC, see Vetal series.	Severe: sandstone at depth of 20 to 36 inches.	Severe: moderately rapid permeability; sandstone at depth of 20 to 36 inches.	Slight: sandstone rippable.	Moderate: sandstone rippable.	Severe: moderately rapid permeability.	Slight: sandstone rippable.
Hoven: HmA, HnA	Severe: very slow permeability.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: flooding; high shrink-swell potential.	Severe: flooding; difficult to work.	Severe: flooding; subject to frost heaving; high shrink-swell potential.
*Huggins: HuA, HwB For Kadoka part of HwB, see Kadoka series.	Severe: moderately slow permeability; siltstone at depth of 20 to 30 inches.	Severe: siltstone at depth of 20 to 30 inches.	Severe: siltstone at depth of 20 to 30 inches.	Severe: siltstone at depth of 20 to 30 inches.	Moderate: siltstone rippable by machinery.	Moderate: siltstone at depth of 20 to 30 inches; moderate to high shrink-swell potential.
*Kadoka: KaA, KbC, KdB, KdC For Epping part of KbC, see Epping series; for Huggins part of KdB, and KdC, see Huggins series.	Severe: siltstone at depth of 20 to 40 inches.	Severe: siltstone at depth of 20 to 40 inches.	Moderate: siltstone generally soft.	Moderate: moderate shrink-swell potential; siltstone rippable.	Moderate: siltstone rippable.	Moderate: moderate shrink-swell potential.
*Keith: KeA, KeC, KgD For Epping part of KgD, see Epping series.	Moderate: moderate permeability.	Moderate to severe: slopes.	Slight to moderate: slopes.	Moderate: moderate shrink-swell potential.	Slight	Moderate: moderate shrink-swell potential.
*Keota: KhE, KkD, KrF For Epping part of KhE, see Epping series; for Kadoka part of KkD, see Kadoka series.	Severe: siltstone at depth of 20 to 40 inches.	Severe: siltstone at depth of 20 to 40 inches.	Moderate: siltstone generally soft.	Moderate: siltstone rippable.	Moderate: siltstone rippable.	Severe: slopes; siltstone rippable; AASHO index 78.
Keya: Ky	Moderate to severe: moderate permeabillty; run-in water in places.	Moderate: moderate permeability; severe if unprotected from run-in water.	Moderate to severe: moderately well drained; run-in water in places.	Moderate to severe: moderate shrink-swell potential; run-in water in places.	Moderate to severe: run-in water in places.	Moderate: moderate shrink-swell potential.

See footnotes at end of table.

of engineering properties—Continued

Suitability as source of—			Soil features affecting—					
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Fair: somewhat poorly drained.	Poor: water table; more than 12 percent fines.	Poor: blows easily; sandy.	Good for ground water dugouts; high water table.	Good stability; fair to good compaction; pipes.	Seasonal high water table.	Water table; rapid intake rate; poor drainage.	Water table; rapid permeability.	Not applicable.
Fair: slopes	Not suited	Poor: thin surface layer.	Shallow to siltstone; high seepage potential.	Poor stability; limited material.	Siltstone at depth of less than 20 inches.	Siltstone at shallow depth.	Siltstone at shallow depth.	Not applicable.
Poor: very poorly drained.	Poor: high water table; more than 12 percent fines.	Poor: very poorly drained.	Good for ground water dugouts; high water table.	High in organic material.	Surface ponding in places; outlets not always available.	Very poorly drained.	Not applicable	Not applicable.
Fair: moderate shrink-swell potential.	Not suited	Good to fair	Slight seepage potential in places; moderate permeability.	Fair stability; medium to high compressibility.	Moderate permeability.	High available water capacity; moderately slow intake rate.	Not applicable	Features favorable.
Good	Not suited	Fair: blows easily.	Too porous to hold water; moderately rapid permeability; sandstone at depth of 20 to 36 inches.	Good stability; fair to good compaction; pipes.	Sandstone at depth of 20 to 36 inches.	Very low to low available water capacity; moderately rapid intake rate.	Sandstone at depth of 20 to 36 inches.	High erodibility.
Poor: poorly drained; high shrink-swell potential.	Not suited	Poor: thin surface layer.	Good dugout site; very slow permeability.	Fair to poor stability; high shrink-swell potential; low shear strength.	Very slow permeability; available outlets scarce.	Very slow permeability; poorly drained; flooding.	Not applicable	Not applicable.
Poor: limited material; moderate shrink-swell potential.	Not suited	Poor: thin surface layer.	Seepage potential if siltstone is fractured.	Fair stability; limited material.	Siltstone at depth of 20 to 30 inches.	Siltstone at depth of 20 to 30 inches.	Siltstone at depth of 20 to 30 inches.	Cuts expose siltstone.
Fair: moderate shrink-swell potential.	Not suited	Fair: limited material; silty clay loam subsoil.	Seepage potential in places; siltstone at depth of 20 to 40 inches.	Fair to poor stability and compaction; potential piping; medium to high compressibility.	Siltstone at depth of 20 to 40 inches.	Moderate available water capacity; moderately slow intake rate.	Moderate permeability; siltstone at depth of 20 to 40 inches.	Slight to moderate erodibility.
Fair: moderate shrink-swell potential.	Not suited	Fair: silty clay loam texture.	Slight seepage potential in places, moderate permeability.	Fair to poor stability.	Moderate permeability.	High available water capacity; moderately slow intake rate.	Features favorable.	Slight to moderate erodibility.
Fair: limited material; AASHO index 78.	Not suited	Poor: thin surface layer; low fertility.	Seepage potential in siltstone.	Poor resistance to piping; poor stability and compaction.	Siltstone at depth of 20 to 40 inches.	Low to moderate available water capacity; slopes too steep; moderately slow intake rate.	Siltstone at depth of 20 to 40 inches.	Cuts expose siltstone; erodible.
Fair: moderate shrink-swell potential.	Not suited	Good	Moderately rapid permeability in substratum.	Fair to poor stability and compaction; pipes.	Moderate permeability.	High available water capacity; moderately slow intake rate.	Not applicable	Features favorable.

TABLE 5.—*Interpretations*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank filter fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfills [1]	Local roads and streets
*Loup: Le For Elsmere part, see Elsmere series.	Severe: high water table.	Severe: rapid permeability; high water table.	Severe: sloughing; high water table.	Severe: high water table.	Severe: water table.	Severe: poorly drained.
Millboro: MbA, MbB, MbC	Severe: slow permeability.	Slight: moderate on slopes of more than 2 percent.	Severe: clayey material.	Severe: high shrink-swell potential.	Severe: difficult to work; clay texture.	Severe: high shrink-swell potential.
Minatare Mapped only in complex with Mosher soils.	Severe: very slow permeability.	Moderate: moderate permeability in underlying marial.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; poor cover material; clayey texture.	Severe: highly susceptible to frost heaving; high shrink-swell potential.
*Mosher: MhA, MmA For Minatare part of MmA, see Minatare series.	Severe: very slow permeability.	Severe: underlying material pervious in places; fluctuating water table.	Severe: moderately well drained; gravelly in places; fluctuating water table.	Severe: high shrink-swell potential.	Severe: difficult to work; fluctuating water table.	Severe: high shrink-swell potential.
*Okreek: OkC, OoE For Orella part of OoE, see Orella series.	Severe: slow permeability; shale at depth of 30 to 40 inches.	Severe: shale at depth of 30 to 40 inches.	Severe: slopes; clay texture.	Severe: high shrink-swell potential.	Severe: difficult to work; clayey texture.	Severe: high shrink-swell potential.
Orella: OrF	Severe: slow permeability; shale at depth of 8 to 15 inches.	Severe: slopes; shale at depth of 8 to 15 inches.	Severe: clayey; shale at shallow depth.	Severe: shale at shallow depth; high shrink-swell potential.	Severe: difficult to work; clayey texture.	Severe: high shrink-swell potential.
*Richfield: RcE, RdA, RhB For Canyon part of RcE, see Canyon series; for Dawes part of RdA, see Dawes series; for Tuthill part of RhB, see Tuthill series.	Severe: moderately slow permeability.	Moderate: sandstone at depth of 40 to 60 inches in places.	Slight to moderate: sandstone at depth of 40 to 60 inches in places.	Moderate: moderate shrink-swell potential.	Moderate: sandstone generally rippable.	Moderate: moderate shrink-swell potential.
*Ronson: RnA, RnB For Anselmo part, see Anselmo series.	Severe: sandstone at depth of 20 to 40 inches.	Severe: moderately rapid permeability; sandstone at depth of 20 to 40 inches.	Moderate: sandstone rippable.	Moderate: sandstone rippable.	Severe: moderately rapid permeability; poor cover material.	Slight: sandstone rippable.
*Samsil: SbE For Boyd part, see Boyd series.	Severe: slow permeability; slopes; shale at depth of 5 to 18 inches.	Severe: slopes; shale at shallow depth.	Severe: slopes; shale at shallow depth.	Severe: slopes; shale at shallow depth; high shrink-swell potential.	Severe: clay texture.	Severe: slopes; subject to frost heaving; high shrink-swell potential.
Shena: SnC	Severe: siltstone at shallow depth.	Severe: siltstone at shallow depth.	Severe: siltstone at shallow depth.	Severe: siltstone at shallow depth.	Severe: siltstone at shallow depth.	Severe: siltstone at shallow depth.
*Tassel: TcF, TfE For Ronson part of TfE, see Ronson series.	Severe: sandstone at depth of 6 to 18 inches.	Severe: slopes; sandstone at depth of 6 to 18 inches.	Severe: slopes; sandstone at depth of 6 to 18 inches.	Severe: slopes; sandstone at depth of 6 to 18 inches.	Severe: moderately rapid permeability; poor cover material.	Severe: slopes.
*Tuthill: ThA, ThB, ThC, TnC, TtC, TvA, TwA. For Anselmo part of TnC, see Anselmo series; for Tassel part of TtC, see Tassel series; for Vetal part of TvA, see Vetal series; for Wortman part of TwA, see Wortman series.	Slight to moderate: depending upon slopes.	Severe: porous below depth of 29 inches.	Severe: loamy sand substratum.	Moderate: moderate shrink-swell potential in subsoil.	Severe: rapid permeability below depth of 29 inches.	Moderate: moderate shrink-swell potential in subsoil.

See footnotes at end of table.

of engineering properties—Continued

Suitability as source of—				Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Poor: poorly drained.	Poor: more than 12 percent fines, high water table.	Poor: sandy	Good for ground water dugouts; high water table.	Good stability; fair to good compaction; pipes.	Low wet areas; outlets not always available.	High water table; poorly drained	Not applicable	Not applicable.
Poor: high shrink-swell potential.	Not suited	Poor: clayey	Features favorable; slow permeability.	Fair to poor stability and compaction.	Slow permeability.	Very slow intake rate; low to moderate available water capacity.	Slow permeability.	Erodible.
Poor: high shrink-swell potential.	Not suited	Poor: high in sodium; low fertility; thin surface layer.	Possible seepage in underlying material.	Poor to fair stability and compaction; pipes.	Very slow permeability; claypan subsoil; 3 to 7 feet to water table.	High in sodium; claypan subsoil.	Unstable; high in exchangeable sodium.	Not applicable.
Poor: high shrink-swell potential.	Not suited	Poor: thin surface layer.	Possible seepage in underlying material.	Fair to poor stability and compaction.	Very slow permeability.	High in sodium; claypan subsoil.	Unstable; high in exchangeable sodium.	Not applicable.
Poor: high shrink-swell potential.	Not suited	Poor: clayey	Shale at depth of 30 to 40 inches; possible seepage.	Fair to poor stability and compaction.	Shale at depth of 30 to 40 inches.	Low available water capacity; very slow intake rate.	Slow permeability.	Erodible.
Poor: high shrink-swell potential.	Not suited	Poor: thin surface layer; clayey.	Shale at depth of 8 to 15 inches; possible seepage.	Fair to poor stability and compaction.	Shale at depth of 8 to 15 inches.	Shale at shallow depth.	Shale at shallow depth.	Erodible.
Fair: moderate shrink-swell potential.	Not suited	Fair: 8 to 16 inches thick.	Slight seepage potential in underlying sandstone.	Fair to poor stability and compaction.	Moderately slow permeability; sandstone at depth of 40 to 60 inches in places.	Moderate to high available water capacity; slow intake rate.	Features favorable.	Slight to moderate erodibility.
Good	Not suited	Fair: easily blown.	Too porous to hold water.	Good stability; fair to good compaction; pipes.	Sandstone at depth of 20 to 40 inches.	Low available water capacity; moderately rapid intake rate.	Sandstone at depth of 20 to 40 inches.	High erodibility.
Poor: limited material over shale; high shrink-swell potential.	Not suited	Poor: clay texture.	Shale at depth of 5 to 18 inches; possible seepage.	Unstable: subject to sliding.	Shale at depth of 5 to 18 inches.	Shale at shallow depth.	Shale at depth of 5 to 18 inches.	Shale at shallow. depth.
Poor: limited material over siltstone.	Not suited	Poor: thin surface layer.	Potential seepage in fractured siltstone.	Limited material above siltstone.	Siltstone at depth of 7 to 15 inches.	Siltstone at shallow depth.	Siltstone at depth of 7 to 15 inches.	Siltstone at shallow depth.
Good to fair: slopes.	Not suited	Poor: thin surface layer.	Sandstone at depth of 6 to 18 inches; high seepage.	Good stability; piping hazard; fair to good compaction; sandstone at depth of 6 to 18 inches.	Sandstone at depth of 6 to 18 inches.	Sandstone at depth of 6 to 18 inches.	Sandstone at depth of 6 to 18 inches.	Sandstone at shallow depth.
Fair: moderate shrink-swell potential in subsoil.	Poor: more than 12 percent fines.	Fair: 8 to 16 inches thick.	Potential for seepage; rapid permeability in substratum.	Fair stability; fair to good compaction; pipes.	Sandy substratum.	Moderate available water capacity; moderate intake rate.	Sandy material below depth of 20 inches.	Slight to moderate erodibility.

TABLE 5.—*Interpretations*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank filter fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfills [1]	Local roads and streets
*Valentine: VaE, VdC, VsE---- For Dunday part of VdC, see Dunday series; for Tassel part of VsE, see Tassel series.	Slight to severe; depending on slope.[2]	Severe: rapid permeability.	Severe: sloughing; fine sand texture.	Slight to severe; depending on slope.	Severe: rapid permeability; poor cover material.	Slight to severe; depending on slope.
Vetal: Vt----	Slight [2]----	Severe: moderately rapid permeability.	Moderate: sloughing below depth of 4 feet; loamy sand texture.	Slight----	Severe: moderately rapid permeability.	Slight----
*Wanblee: WbA---- For Wortman part, see Wortman series.	Severe: slow permeability; siltstone at depth of 20 to 30 inches.	Severe: siltstone at depth of 20 to 30 inches.	Severe: somewhat poorly drained; silt stone at depth of 20 to 30 inches.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; poor cover material.	Severe: subject to frost heaving; siltstone at depth of 20 to 30 inches.
Wann: Wd, We----	Severe: subject to flooding.	Severe: subject to flooding.	Severe: somewhat poorly drained; sloughing below depth of 4 feet.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: flooding; somewhat poorly drained.
Whitelake: WhA----	Severe: slow permeability in subsoil; seasonal water table.	Severe: seasonal water table; moderately rapid permeability in substratum.	Moderate: moderately well drained.	Moderate: moderately well drained; moderate shrink-swell potential in subsoil.	Severe: seasonal water table.	Moderate: subject to frost heaving; moderate shrink-swell potential in subsoil.
Wortman: WoA, WrA----	Severe: very slow permeability; siltstone at depth of 20 to 40 inches.	Severe: siltstone at depth of 20 to 40 inches.	Moderate: siltstone rippable.	Severe: moderate shrink-swell potential; siltstone rippable.	Severe: clayey subsoil; siltstone rippable.	Severe: siltstone at depth of 20 to 40 inches; high shrink-swell potential.

[1] Onsite deep studies of the underlying strata, water tables, and the hazards of aquifer pollution and drainage into ground water need to be made for landfills deeper than 5 or 6 feet.

of engineering properties—Continued

Suitability as source of—			Soil features affecting—					
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Good on slopes less than 15 percent; fair on slopes greater than 15 percent.	Fair to poor for fine sand.	Poor: sandy	Too porous to hold water; rapid permeability.	Good stability; fair to good compaction; pipes.	Rapid permeability; slopes.	Low available water capacity; very rapid intake rate; very erodible.	Not applicable	Not applicable.
Good	Not suited	Fair: easily blown.	Too porous to hold water; rapid permeability in substratum.	Good stability; fair to good compaction; pipes.	Sandy substratum.	Moderate available water capacity; moderately rapid intake rate.	Not applicable	Moderate erodibility.
Poor: high shrink-swell potential.	Not suited	Poor: thin surface layer.	Potential seepage in siltstone.	Poor stability; piping hazard.	Slow permeability; siltstone at depth of 20 to 30 inches.	Claypan subsoil; siltstone at depth of 20 to 30 inches.	Not applicable	Not applicable.
Fair: somewhat poorly drained.	Poor: more than 12 percent fines.	Fair: easily blown.	Good for ground water dugouts; high water table.	Food stability; fair to good compaction; pipes.	Subject to flooding.	Moderate available water capacity; water table at depth of 3 to 6 feet.	Water table at depth of 3 to 6 feet.	Not applicable.
Fair: moderately well drained.	Not suited	Fair: easily blown.	Good for ground water dugouts; seasonal water table.	Fair to poor stability and compaction; pipes.	Slow permeability in subsoil.	Slow permeability; subject to salt accumulation.	Seasonal water table.	Not applicable.
High shrink-swell potential.	Not suited	Poor: thin surface layer.	Potential for seepage in siltstone.	Fair to poor stability; piping hazard.	Very slow permeability.	Claypan subsoil; siltstone at depth of 20 to 40 inches.	Siltstone at depth of 20 to 40 inches.	Not applicable.

[2] Potential exists for contaminating ground water.

TABLE 6.—*Engineering*

[Tests performed by the South Dakota Department of Highways in cooperation with the U.S. Department of Commerce, Bureau of Public
indicates no determi

Soil name and location	Parent material	Depth from surface	Mechanical analysis [1]		
			Percentage passing sieve—		
			1 in.	¾ in.	⅜ in.
		Inches			
Anselmo fine sandy loam: 300 feet S. and 1,760 feet W. of NE. corner of sec. 19, T. 38 N., R. 28 W.	Eolian sand.	8–22 26–60	-------- --------	-------- --------	-------- --------
Holt fine sandy loam: 200 feet E. and 150 feet S. of NW. corner of sec. 14, T. 37 N., R. 28 W.	Sandstone.	7–14 22–34	-------- 100	-------- 95	-------- 94
Millboro silty clay: 600 feet E. and 700 feet N. of SW. corner of sec. 7, T. 39 N., R. 25 W.	Clay.	5–17 40–60	-------- --------	-------- --------	-------- --------
Valentine fine sand: 1,500 feet N. and 450 feet E. of SW. corner of sec. 7, T. 36 N., R. 31 W.	Eolian sand.	12–60	--------	--------	--------

[1] Mechanical analysis according to the AASHO Designation T 88–57 (*2*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser

strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 6; the estimated classification, without group index numbers, is given in table 4 for all soils mapped in the survey area.

Estimated engineering properties

Table 4 gives estimates of some of the soil properties that are important to engineering. The estimates are based on test data shown in table 6, on test data for similar soils from adjacent counties, on soil tests performed at construction sites by the South Dakota Highway Department, and on knowledge of the soils obtained during the soil survey. A complete description of a profile representative of the series is given in the section "Descriptions of the Soils." Some of the terms used to describe soils, and for which data are shown in table 4, are explained in the following paragraphs.

Soil permeability is the quality of a soil that enables it to transmit water and air. It is measured in terms of the rate at which water passes through undisturbed and uncompacted soil. It does not include lateral seepage.

Available water capacity is the ability of soils to hold water available for use by most plants. It commonly is defined as the difference between the amount of soil water at field capacity and the amount at wilting point of plants. It commonly is expressed as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. Relative terms and their range of pH values are defined in the Glossary.

Shrink-swell potential is an indication of the volume change that can be expected of soil material with changes in moisture content. Shrinking and swelling of soils can cause damage to building foundations, roads, and other structures constructed in, on, or with soil material.

Corrosivity indicates the potential danger to uncoated steel or concrete structures through chemical action that dissolves or weakens the structural material. Structural material corrodes more easily in some kinds of soil than in others. Extensive installations that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations in one kind of soil or soil horizon.

Interpretations of engineering properties

Table 5 provides information useful to engineers and others who plan to use soil material in the construction of engineering works. The first part of the table gives the degree and kind of limitations that the soils of Todd County have for sewage disposal systems, shallow excavations, dwellings with basements, sanitary landfill, and roads and streets. The second part rates the soils as to their suitability as a source for road fill, for sand and gravel, and for topsoil. The third part lists soil features

test data

Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO). Absence of an entry nation was made]

Mechanical analysis [1]—Continued					Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued				Percentage smaller than 0.005 mm.				
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				AASHO	Unified
					Pct.			
----------	100	94	32	12	20	4	A–2–4(0)	SM–SC
----------	100	96	24	8	18	3	A–2–4(0)	SM
----------	100	97	30	10	22	[2] NP	A–2–4(0)	SM
94	94	88	32	6	24	4	A–2–4(0)	SM–SC
----------	100	99	90	50	57	31	A–7–6(19)	CH
----------	100	99	88	50	50	23	A–7–6(15)	ML–CL
----------	100	95	5	----------	----------	NP	A–3(0)	SP–SM

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in determining the textural class of a soil.

[2] Nonplastic.

that affect the construction of devices to control erosion and to conserve water. The ratings and other interpretations in this table are based on engineering properties of soils given in table 4, on available test data, and on field experience. The information applies only to soil depths indicated in table 4, generally about 5 feet.

Soil limitations are indicated by the ratings *slight*, *moderate*, and *severe*. *Slight* means soil properties generally favorable for the rated use or, in other words, limitations that are minor and easily overcome. *Moderate* means that some soil properties are unfavorable, but can be overcome or modified by special planning and design. *Severe* means soil properties so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special designs.

Soil suitability is rated by the terms *good*, *fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms *slight*, *moderate*, and *severe*.

Limitations listed for roads and streets apply to the construction and maintenance of improved roads and streets having some kind of all-weather surfacing. Such roads and streets are expected to carry automobile traffic all year, but not fast-moving heavy trucks.

The sand and gravel ratings are based on the probability that the areas shown on the soil map contain deposits of sand and gravel. The ratings do not indicate quality or size of the deposits.

Shallow excavations are less than 6 feet deep and generally apply to basements, ditches, graves, underground cables, pipelines, and sewers.

Limitations indicated in table 5 for sanitary landfills are useful in selecting alternate sites. They are not a substitute for detailed geologic investigations made to greater depths.

Engineering test data

Table 6 contains the results of testing soil samples from four profiles. The soils were tested by the South Dakota Department of Highways in cooperation with the Bureau of Public Roads.

The data for liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid or semisolid to a plastic state. The plastic limit is the moisture content at this point. If the moisture content is further increased, the material changes from a plastic to a liquid state and the moisture content at this point is the liquid limit. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Formation and Classification of the Soils

This section consists of two main parts. The first part tells how the factors of soil formation have affected the development of soils in Todd County. The second part explains the system of soil classification currently used and places each soil series in the main classes of that system.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineral composition of the parent material, the climate under which the soil material has accumulated and existed, the plant and animal life on and in the soil, the relief, or lay of the land, and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. Plants are the chief factor. These factors act on the parent material that has accumulated through the weathering of rocks and slowly change it to a material that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in some cases, determine it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for the differentiation of soil horizons. Usually a long time is required for the development of distinct horizons.

In the following paragraphs, the factors of soil formation as they apply to Todd County soils are briefly discussed.

Parent material

Some of the soils in Todd County formed in material weathered from the underlying geologic material. Some formed in material transported by wind and water.

The Pierre Formation is exposed in the northeastern part of the county. It is the oldest underlying bedrock that is exposed and is a marine shale that was deposited during the Cretaceous Age (*7*, *8*). It is a dark-gray clay shale that contains beds of bentonite and seams of limestone, iron, and manganese concretions. Soils of the Boyd, Millboro, and Samsil series formed in clays weathered from the Pierre Formation.

Sediment of Tertiary Age is near the surface in much of the county. It was deposited by fresh-water streams after the Cretaceous Age. The Tertiary Age deposits in Todd County are represented by the White River Group and the Ogallala Group.

The White River Group overlies the Pierre Formation and is the surface formation across the northern one-third of the county. The Chadron Formation is the lower member and consists mainly of gray bentonitic clays. The upper member is the Brule Formation and consists of pink silts and siltstones (*1*, *6*, *7*, *8*). Soils of the Okreek and Orella series formed in clayey material weathered from the Chadron Formation. Soils of the Epping, Huggins, Kadoka, Keota, and Shena series formed in silty material weathered from the Brule Formation.

The surface formation across the southern part of the county is that of the Ogallala Group. The Valentine Formation is mainly a very light gray or green, unconsolidated to poorly consolidated, calcareous sandstone (*1*, *7*). The Ash Hollow Formation consists of fine-grained sandstones and siltstones that are moderately cemented. Among the soils formed in materials weathered from these formations are those of the Canyon, Duda, Holt, Ronson, and Tassel series.

The Sand Hills Formation is in the southwestern part of the county. It consists of fine sands derived from the Ogallala Group and reworked by wind action into a succession of dunes (*4*). Soils mainly of the Dunday and Valentine series formed in these materials.

Deposits of uniformly textured silty material are scattered throughout the central part of the county. These windblown deposits are the parent material of the Keith and Richfield soils.

The Goshen and Keya soils are examples of soils formed in alluvium transported from adjacent slopes. Wann soils are examples of soils formed in alluvium recently deposited along streams.

Climate

The climate of Todd County is characterized by hot, dry summers and cold winters. Such a climate is favorable to grassland. Because the climate is relatively uniform throughout the county, differences that exist in the soils of Todd County are not due to climate. Climatic data are given in the section "General Nature of the County."

Plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi are important in the formation of soils. Among the changes they cause are gains in organic matter, gains or losses in plant nutrients, and changes in structure and porosity.

Todd County soils formed under a cover of grasses, which accounts for the moderate to high content of organic matter in the upper horizons of the soil profiles. Native trees on uplands grow mostly in thin stands that have a vigorous understory of grasses. Native trees on bottom lands grow mainly on sites with more favorable moisture conditions. The scattered stands of trees appear to have had little influence on formation of the soils.

The influence of animal life on the soils of the county is limited by the subhumid climate. Earthworms are active in such friable, silty soils as Goshen, Keith, and Keya soils, but they are not in sandy soils such as Valentine soils. Burrowing animals have mixed the soil horizons in places.

Relief

In Todd County relief has influenced soil formation through its effect on drainage and runoff. The Canyon, Epping, Orella, Tassel, and Samsil are examples of the steeper soils of the county that lose much of the rainfall through runoff. Such soils form slowly because little moisture enters the soil and because natural erosion is active. Runoff is slower on such gently sloping soils as the Boyd, Holt, Kadoka, and Keith soils, and they receive more water. Deeper and more complete soil formation occurs on nearly level areas or areas where slopes are concave, and these areas receive extra water. The Goshen and Keya soils are examples of soils that formed under such conditions. The Elsmere, Gannett, and Loup soils are examples of soils that formed under the influence of a high water table in some low areas.

Time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in

the kinds of soil that formed. Some landscapes on the tablelands of Todd County have been stable for relatively long periods. Soils on such landscapes are leached of lime to a depth of 24 inches or more, and they have distinct horizons. Richfield and Tuthill soils are examples of such soils. Wann soils on bottom lands are examples of young soils that have little horizon development.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and revised later (*11*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties and was adopted in 1965 (*13*). It is under continual study (*9*).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 7 shows the classification of each soil series of Todd County by family, subgroup, and order, according to the current system.

Order.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate these soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different kinds of climate. Table 7 shows

TABLE 7.—*Soils classified according to the current system*

[The classifications are those of the period during which this survey was written]

Soil series	Family	Subgroup	Order
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
Anselmo	Coarse-loamy, mixed, mesic	Typic Haplustolls	Mollisols.
Boyd	Fine, montmorillonitic, mesic	Vertic Haplustolls	Mollisols.
Canyon	Loamy, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Chappell	Sandy, mixed, mesic	Aridic Haplustolls	Mollisols.
Dawes	Fine, mixed, mesic	Typic Paleustolls	Mollisols.
Dix	Sandy-skeletal, mixed, mesic	Torriorthentic Haplustolls	Mollisols.
Doger	Sandy, mixed, mesic	Typic Haplustolls	Mollisols.
Duda	Mixed, mesic	Typic Ustipsamments	Entisols.
Dunday	Sandy, mixed, mesic	Entic Haplustolls	Mollisols.
Elsmere	Sandy, mixed, mesic	Aquic Haplustolls	Mollisols.
Epping	Loamy, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Gannett	Coarse-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Goshen	Fine-silty, mixed, mesic	Pachic Argiustolls	Mollisols.
Holt	Coarse-loamy, mixed, mesic	Typic Argiustolls	Mollisols.
Hoven	Fine,montmorillonitic, mesic	Typic Natraquolls	Mollisols.
Huggins	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Kadoka	Fine-silty, mixed, mesic	Aridic Argiustolls	Mollisols.
Keith	Fine-silty, mixed, mesic	Aridic Argiustolls	Mollisols.
Keota	Coarse-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Keya	Fine-loamy, mixed, mesic	Pachic Argiustolls	Mollisols.
Loup	Sandy, mixed, mesic	Typic Haplaquolls	Mollisols.
Millboro	Fine, montmorillonitic, mesic	Vertic Argiustolls	Mollisols.
Minatare	Fine, mixed, mesic	Aquic Natrargids	Aridisols.
Mosher	Fine, montmorillonitic, mesic	Typic Natrustolls	Mollisols.
Okreek	Very-fine, montmorillonitic, mesic	Vertic Argiustolls	Mollisols.
Orella	Clayey, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Richfield	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Ronson	Coarse-loamy, mixed, mesic	Typic Haplustolls	Mollisols.
Samsil	Clayey, montmorillonitic (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Shena	Clayey, mixed, mesic, shallow	Aridic Argiustolls	Mollisols.
Tassel	Loamy, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Tuthill	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
Valentine	Mixed, mesic	Typic Ustipsamments	Entisols.
Vetal	Coarse-loamy, mixed, mesic	Pachic Haplustolls	Mollisols.
Wanblee	Fine, mixed, mesic	Ustollic Natrargids	Aridisols.
Wann	Coarse-loamy, mixed, mesic	Fluvaquentic Haplustolls	Mollisols.
Whitelake	Fine-loamy, mixed, mesic	Typic Natrustolls	Mollisols.
Wortman	Fine, mixed, mesic	Typic Natrustolls	Mollisols.

that the three soil orders in Todd County are Entisols, Aridisols, and Mollisols.

Entisols are light-colored soils that do not have natural genetic horizons or that have only very weakly expressed beginnings of such horizons. These soils do not have traits that reflect soil mixing caused by shrinking and swelling.

Aridisols are light-colored mineral soils that are high in bases and have well-expressed mineral genetic horizons.

Mollisols formed under grass and have a thick, dark-colored surface horizon containing colloids dominated by bivalent cations. The material in these soils has not been mixed by shrinking and swelling.

Suborder.—Each order has been subdivided into suborders, primarily on the basis of the characteristics that seemed to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

Great Groups.—Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that contain a pan that interferes with the growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 7, because it is the last word in the name of the subgroup.

Subgroup.—Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the great group.

Family.—Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, minerals, reaction, soil temperature, permeability, thickness of horizons, and consistence.

General Nature of the County

Todd County was created in 1909 by an act of the South Dakota legislature. Earlier it had been part of Lugenbeel and Meyer Counties, which were later abolished. In 1911 the legislature redefined the western boundary of the county to conform with the western boundary of the Rosebud Indian Reservation. The boundaries of the county coincide with those of the Rosebud Indian Reservation.

The federal census in 1960 lists the population of the county as 4,661, which represented a 2 percent loss since 1950. Most of the population is concentrated in the central and north-central parts of the county. Mission is the largest town and the principal business center. Rosebud is the next largest town. Parmelee, St. Francis, Olsonville, Okreek, and Soldier Creek are some of the villages and rural stores.

No railroad passes through the county. U.S. Highway No. 18 crosses the county from east to west and U.S. Highway No. 83 from north to south. Hard-surfaced and gravelled secondary roads connect the villages and rural stores with the main highways.

Most of the agricultural products are marketed outside the county. Most of the cattle are marketed through auction barns in Winner in adjacent Tripp County and in Valentine, Nebraska. Wheat and other grains are trucked to rail points in adjacent counties. A cheese factory in Mission provides a marketing outlet for milk produced by dairy operators.

A county high school is in Mission and a parochial high school is in St. Francis. Consolidated rural elementary schools are in Littleburg and in Lakeview. Several one-room rural schools are elsewhere in the county. A hospital operated by the U.S. Public Health Service is in Rosebud. Several reservoirs and numerous stockwater ponds provide excellent fishing and other recreational activities.

Climate [8]

Todd County has a continental climate that is characterized by cold winters and hot summers. The county is in the south-central part of the State. The western border is about 110 miles east of the southern part of the Black Hills. No large bodies of water are near enough to affect the climate.

Table 8 shows the probability that certain low temperatures will occur after specified dates in spring or before specified dates in fall. These data refer to air temperatures, as measured in a standard instrument shelter. Soil and plant temperatures vary somewhat from the temperature of the free air. Table 9 provides precipitation data. The climatic data presented in tables 8 and 9 are based on records kept in Mission from 1952 to 1965. Mission is in the southeastern part of the county at an elevation of 2,805 feet. The data in these tables are considered representative of the conditions in Todd County.

The annual precipitation averages about 2 inches less in the western part of the county than in the eastern part. The average annual temperature is about 2 degrees less in the northwestern part of the county than in the southeastern part. This lower average temperature is attributed to lower average minimum temperatures. Climate is a limiting factor in the production of crops in the county.

Todd County has wide seasonal and occasionally wide daily variations in temperature. In some years temperatures rise to more than 100° F. in summer and drop to 20° below zero or lower in winter. A reading of 100° or higher can be expected about 3 days each year in July, 2 days each year in August, and 1 day each year in June. Temperatures of 20° below zero or lower can be expected about once a year, generally in January. On the average, the temperature falls to zero or lower on 23 days each

[8] By WALTER SPUHLER, State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 8.—*Probabilities of specified temperatures in spring and fall*

[Data from records kept at Mission, South Dakota, 1952–65. Table prepared by WILLIAM F. LYTLE, South Dakota State University]

Probability	Dates for stated probability and temperature					
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower	36° F. or lower
After specified dates in spring:						
90 percent	March 16	March 18	March 25	April 5	April 29	May 1
70 percent	March 23	March 27	April 4	April 15	May 4	May 9
50 percent	April 5	April 12	April 22	May 3	May 15	May 25
30 percent	April 17	April 26	May 9	May 20	May 24	June 8
10 percent	April 24	May 5	May 19	May 30	May 30	June 17
Before specified dates in fall:						
10 percent	October 17	October 8	October 2	September 14	August 30	August 28
30 percent	October 24	October 15	October 9	September 23	September 9	September 3
50 percent	November 5	October 29	October 21	October 10	September 28	September 16
70 percent	November 16	November 11	November 1	October 25	October 16	September 27
90 percent	November 22	November 18	November 7	November 3	October 26	October 4

year and fails to climb above zero about 1 day each year.

The average annual temperature near Mission is 47.5°. This compares with a 30-year average annual temperature of 46.9° recorded in Valentine, Nebraska, and 49.7° in Wood, South Dakota.

The average annual precipitation at Mission is 18.26 inches, of which 14.74 inches, or 81 percent, falls during the growing season (April through September). During the 14 years of record the annual precipitation ranged from 14 inches in 1959 to 26.95 inches in 1953. At nearby Valentine, Nebraska, during 77 years of record, the annual precipitation ranged from 10.14 inches in 1894 to 28.91 inches in 1929, and the average was 18.47 inches. Thundershowers are the main source of rain during the growing season. The rain varies in intensity and amount. One inch or more of rain in 1 hour can be expected about once each year. Two inches or more of rain in 1 hour can be expected about once in 10 years. About once in 3 years a 24-hour rain of 2 inches or more can be expected, and about once in 15 years a 24-hour rain of 3 inches or more can be expected.

A snow cover is important for protecting pastures and fall-seeded grains, although it can be a hindrance to farm or ranch activities in winter. The average seasonal snowfall near Mission is 39 inches. A snow cover of 1 inch or more averages 56 days per year.

TABLE 9.—*Temperature and precipitation*

[Data from Mission, South Dakota, 1952–65]

Month	Temperature				Precipitation				Average number of days with—	
			Two years in 10 will have—			One year in 10 will have—				
	Average daily maximum	Average daily minimum	Monthly average of daily maximum equal to or higher than—	Monthly average of daily minimum equal to or lower than—	Average total	Less than—	More than—	Average total snowfall	Snowfall of 1 inch or more	Depth of snow cover 1 inch or more
	°F.	°F.	°F.	°F.	In.	In.	In.	In.		
January	33.6	8.7	40.5	2.0	0.23	0.07	0.46	4.3	2	12
February	38.0	12.9	47.8	5.1	.68	.04	1.52	7.6	3	13
March	42.6	18.3	51.3	11.4	.97	.23	1.91	10.6	4	14
April	59.9	32.1	66.4	28.3	2.06	.42	4.07	6.0	1	2
May	71.1	43.9	76.3	41.0	3.23	1.33	5.34	.3	0	0
June	81.3	54.0	87.2	51.1	3.42	1.39	5.69	0	0	0
July	88.8	59.0	93.4	55.8	2.35	.84	4.21	0	0	0
August	87.5	57.5	91.0	54.7	2.15	.47	5.19	0	0	0
September	76.8	46.2	82.8	42.6	1.53	.50	3.03	0	0	0
October	67.3	36.8	73.5	31.6	.89	.09	2.41	.3	0	0
November	48.7	22.8	55.4	17.1	.50	.05	1.38	5.6	1	4
December	37.7	14.2	45.0	7.4	.25	.05	.56	3.9	1	11
Year	61.1	33.9	62.5	32.1	18.26	13.68	23.12	38.6	12	56

Although sunshine, wind, and relative humidity data are not observed near Mission, data from Valentine, Nebraska, can be used to estimate conditions in Todd County. The sun shines on the average of two thirds of the total possible time during the year. The largest percentage of possible sunshine is in July, about 10 percent above average, and the least is in November and December, about 10 percent below average.

Wind speeds average 10 to 11 miles per hour. The prevailing direction is from the northwest in winter and from the south in summer. A wind speed of 50 miles per hour or more can be expected in any month, but it is most likely to occur in summer in association with thunderstorms. Thunderstorms can be expected about 11 days in June, 11 in July, 9 in August, 8 in May, and 4 in September. Fewer thunderstorms occur in other months. The annual average is 45. Hail that occasionally accompanies the thunderstorms can be expected in the Mission area about twice a year. Hail is most likely to fall in July.

The relative humidity in Todd County varies widely from early morning to afternoon and occasionally from day to day. The annual average is about 82 percent in early morning and about 52 percent in the afternoon.

The potential water loss from soil and crops is indicated by the loss from an evaporation pan. The average annual evaporation of water from the Weather Bureau class A pan in this county is about 56 inches. An average of about 44 inches of water evaporates from May to October. The evaporation from small lakes is about 40 inches. The water loss from soil and crops is generally less, and depends upon the available soil moisture.

Farming

Many of the early settlers in Todd County came from states to the east and south. The farming methods they brought with them were not suited to the drier climate or to the sandy and moderately sandy soils. Crop failures forced many of the early settlers to leave the county and caused those who remained to adopt farming methods that would help to maintain moisture and to control erosion. Many changed their primary operations from farming to livestock ranching. Abandoned farmsteads, sand deposits on old fence lines, and some severely eroded fields are the scars left of early farming operations in Todd County.

Ranching and dryland farming are the main enterprises in Todd County. Feeder cattle are the main product sold. The present trend is toward fewer and larger farms and ranches. According to the U.S. Census of Agriculture, in 1960 Todd County had a total of 347 farms whose average size was 2,371 acres.

On January 1, 1966 (*10*) 72,500 cattle were on farms and ranches. This number included 1,500 dairy cattle. Also on farms and ranches in that year were 5,400 hogs and 3,100 sheep.

The major crops in this county are alfalfa, oats, corn, sorghum, and barley. In 1965 (*10*) alfalfa hay was harvested from 37,500 acres; oats for grain from 10,600 acres; corn for grain from 10,300 acres; wheat from 9,140 acres; sorghum for grain from 2,700 acres; and barley for grain from 2,200 acres. Alfalfa seed was harvested from 2,700 acres.

Information about the past history of cropping and livestock numbers in the county can be obtained from the annual reports of the South Dakota Crop and Livestock Reporting Service (*10*).

Literature Cited

(1) AGNEW, A. F.,
1963. GEOLOGY OF THE MISSION QUADRANGLE. S. Dak. Geol. Survey. Map and text.

(2) AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS.
1961. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., illus., Washington, D.C.

(3) BALDWIN, M., KELLOGG, C. E., and THORP, J.
1938. SOIL CLASSIFICATION. U.S. Dept. Agr. Yearbook: pp. 979–1001, illus.

(4) COLLINS, S. G.
1959. GEOLOGY OF THE MARTIN QUADRANGLE. S. Dak. Geol. Survey. Map and text.

(5) KLINGEBIEL, A. A., and MONTGOMERY, P. H.
1961. LAND CAPABILITY CLASSIFICATION. U.S. Dept. Agr. Handbook 210, 21 pp., illus.

(6) SEVON, W. D.
1959. GEOLOGY OF THE OKREEK QUADRANGLE. S. Dak. Geol. Survey. Map and text.

(7) ———
1960. GEOLOGY OF THE RING THUNDER QUADRANGLE. S. Dak. Geol. Survey. Map and text.

(8) SHOON, R. A.
1957. GEOLOGY OF THE WITTEN QUADRANGLE. S. Dak. Geol. Survey. Map and text.

(9) SIMONSON, ROY W.
1962. SOIL CLASSFICATION IN THE UNITED STATES. Sci. 137: 1027–1034.

(10) SOUTH DAKOTA CROP AND LIVESTOCK REPORTING SERVICE.
1924–65. SOUTH DAKOTA AGRICULTURAL STATISTICS. Annual Reports.

(11) THORP, JAMES, and SMITH, GUY D.
1949. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUPS. Soil Sci. 67: 117–126, illus.

(12) UNITED STATES DEPARTMENT OF AGRICULTURE.
1951. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handb. 18, 503 pp., illus.

(13) ———
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. Soil Survey Staff, Soil Conservation Service, 265 pp., illus. [Supplements issued in March 1967 and September 1968]

(14) UNITED STATE DEPARTMENT OF DEFENSE.
1968. UNIFIED SOIL CLASSIFICATION SYSTEM FOR ROADS, AIRFIELDS, EMBANKMENTS, AND FOUNDATIONS. MIL-STD–619B, 30 pp., illus.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Blowout. An excavation produced by wind action in loose soil, usually sand.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Gravel. Rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residue.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of the soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Parent material. The disintegrated and partly weathered rock from which soil has formed.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons is unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting of winter grains.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457–3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

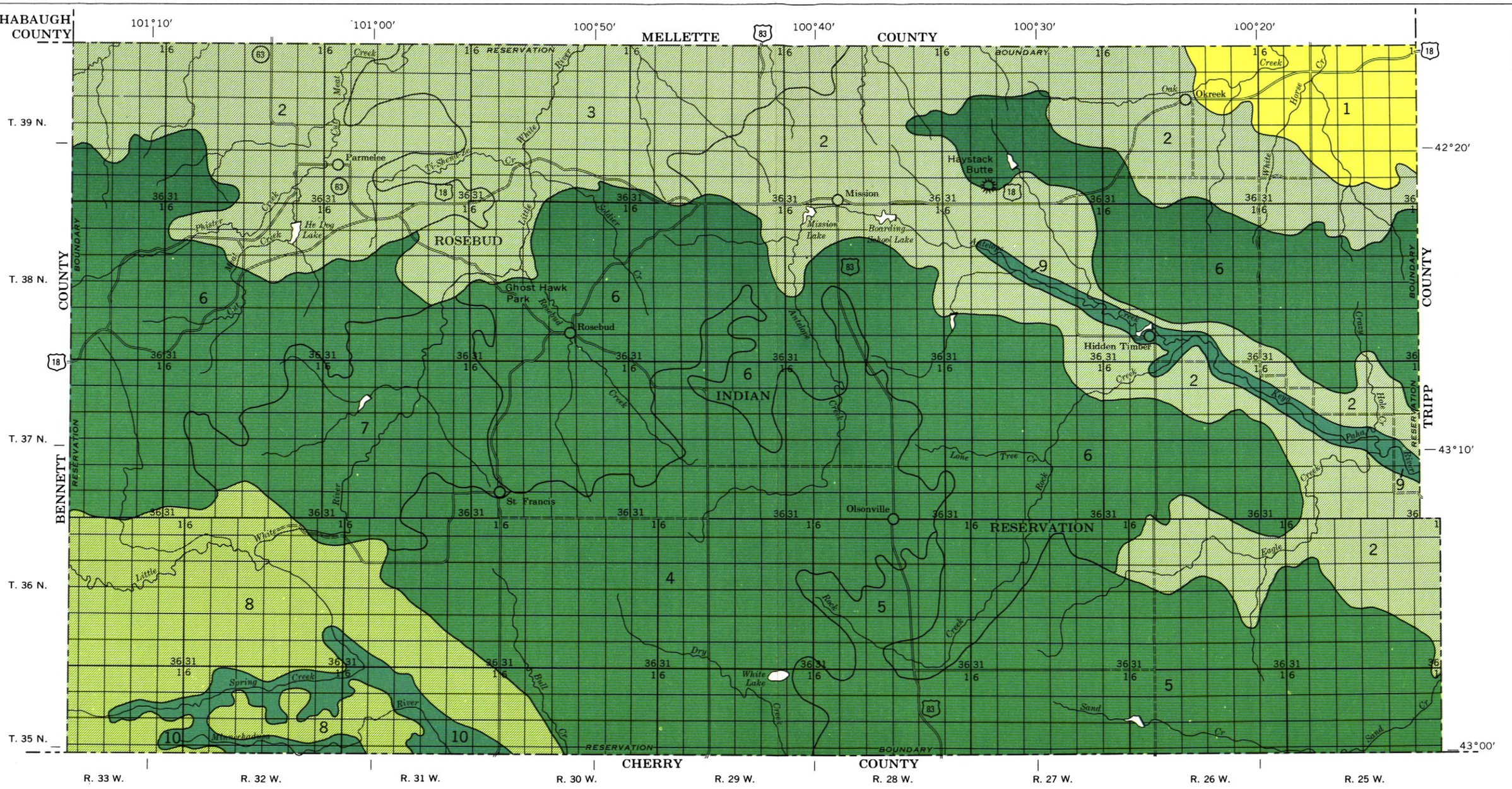
The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers. If you believe you experienced discrimination when obtaining services from USDA, participating in a USDA program, or participating in a program that receives financial assistance from USDA, you may file a complaint with USDA. Information about how to file a discrimination complaint is available from the Office of the Assistant Secretary for Civil Rights. USDA prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex (including gender identity and expression), marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.)

To file a complaint of discrimination, complete, sign, and mail a program discrimination complaint form, available at any USDA office location or online at www.ascr.usda.gov, or write to:

USDA
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, S.W.
Washington, DC 20250-9410

Or call toll free at (866) 632-9992 (voice) to obtain additional information, the appropriate office or to request documents. Individuals who are deaf, hard of hearing, or have speech disabilities may contact USDA through the Federal Relay service at (800) 877-8339 or (800) 845-6136 (in Spanish). USDA is an equal opportunity provider, employer, and lender.

Persons with disabilities who require alternative means for communication of program information (e.g., Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).



NEBRASKA

SOIL ASSOCIATIONS *

WELL-DRAINED CLAYEY SOILS OVER SOFT CLAY SHALE; ON UPLANDS

1 Millboro-Boyd association: Deep and moderately deep, nearly level, to steep, well-drained clayey soils; on uplands

WELL-DRAINED TO SOMEWHAT EXCESSIVELY DRAINED SILTY AND LOAMY SOILS OVER SILTSTONE; ON UPLANDS

2 Kadoka-Tuthill-Huggins association: Moderately deep and deep, nearly level to sloping, well-drained silty and loamy soils; on uplands

3 Epping-Keota-Kadoka association: Shallow and moderately deep, sloping to steep, well-drained to somewhat excessively drained silty soils; on uplands

WELL-DRAINED AND SOMEWHAT EXCESSIVELY DRAINED LOAMY AND SANDY SOILS OVER SANDSTONE; ON UPLANDS

4 Holt-Anselmo-Vetal association: Moderately deep and deep, nearly level to undulating, well-drained loamy soils; on uplands

5 Anselmo-Ronson-Vetal association: Deep and moderately deep, nearly level to rolling, well-drained loamy soils; on uplands

6 Anselmo-Tassel-Dunday association: Deep and shallow, gently undulating to steep, well-drained and somewhat excessively drained loamy and sandy soils; on uplands

7 Rough broken land-Doger association: Deep, nearly level to very steep, well-drained and somewhat excessively drained mixed sandy soils; on uplands

EXCESSIVELY DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SANDY SOILS FORMED IN EOLIAN SANDS; ON UPLANDS

8 Valentine-Dunday association: Deep, gently undulating to steep, excessively drained and somewhat excessively drained sandy soils; on uplands

SOMEWHAT POORLY DRAINED TO VERY POORLY DRAINED SANDY AND LOAMY SOILS FORMED IN ALLUVIUM; IN STREAM VALLEYS

9 Elsmere-Wann association: Deep, nearly level, somewhat poorly drained sandy and loamy soils; on bottom lands and low terraces

10 Elsmere-Loup association: Deep, nearly level, somewhat poorly drained to very poorly drained sandy soils; on bottom lands

Compiled 1972

*Texture refers to the surface layer of the major soils unless otherwise stated.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U. S. DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

TODD COUNTY, SOUTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Miles

This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.

INDEX TO MAP SHEETS

TODD COUNTY, SOUTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Miles

WASHABAUGH COUNTY

MELLETTE COUNTY

CHEYENNE RIVER RESERVATION BOUNDARY

ROSEBUD INDIAN RESERVATION

TRIPP COUNTY

BENNETT COUNTY

CHERRY COUNTY

NEBRASKA

101°10′ 101°00′ 100°50′ 100°40′ 100°30′ 100°20′

43°10′ 43°00′

T. 39 N. T. 38 N. T. 37 N. T. 36 N. T. 35 N.

R. 33 W. R. 32 W. R. 31 W. R. 30 W. R. 29 W. R. 28 W. R. 27 W. R. 26 W. R. 25 W.

Parmelee, Mission, Haystack Butte, Okreek, Rosebud, Ghost Hawk Park, Hidden Timber, St. Francis, Olsonville

Inset, sheet 15 — 42°20′

Inset, sheet 30

Inset, sheet 39

Inset, sheet 40

Inset, sheet 41

Inset, sheet 42

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TODD COUNTY, SOUTH DAKOTA

U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of soils or land types that are nearly level, but some are for soils or land types that have a considerable range of slope.

SYMBOL	NAME
AlA	Altvan loam, 0 to 2 percent slopes
AlB	Altvan loam, 2 to 5 percent slopes
AnB	Anselmo fine sandy loam, 2 to 5 percent slopes
AnC	Anselmo fine sandy loam, 5 to 9 percent slopes
ArC	Anselmo-Ronson fine sandy loams, 5 to 9 percent slopes
AtE	Anselmo-Tassel fine sandy loams, 9 to 21 percent slopes
AuE	Anselmo-Tuthill fine sandy loams, 9 to 21 percent slopes
AvA	Anselmo-Vetal fine sandy loams, 0 to 2 percent slopes
BsD	Boyd-Samsil clays, 6 to 19 percent slopes
CaA	Chappell-Anselmo fine sandy loams, 0 to 3 percent slopes
CaB	Chappell-Anselmo fine sandy loams, 3 to 5 percent slopes
DcC	Dix-Chappell fine sandy loams, 3 to 9 percent slopes
DfA	Doger loamy fine sand, 0 to 3 percent slopes
DgB	Doger-Dunday loamy fine sands, 3 to 6 percent slopes
DlB	Duda loamy fine sand, 0 to 6 percent slopes
DsA	Dunday loamy fine sand, 0 to 2 percent slopes
DuA	Dunday fine sandy loam, 0 to 2 percent slopes
ElA	Elsmere loamy fine sand, 0 to 3 percent slopes
Ge	Gannett sandy loam
Gh	Goshen silt loam
Gr	Gravelly land
HfA	Holt fine sandy loam, 0 to 3 percent slopes
HlC	Holt-Vetal fine sandy loams, 3 to 9 percent slopes
HmA	Hoven silt loam, 0 to 1 percent slopes
HnA	Hoven silt loam, drained, 0 to 5 percent slopes
HuA	Huggins silt loam, 0 to 2 percent slopes
HwB	Huggins-Kadoka silt loams, 2 to 9 percent slopes
KaA	Kadoka silt loam, 0 to 2 percent slopes
KbC	Kadoka-Epping silt loams, 5 to 9 percent slopes
KdB	Kadoka-Huggins silt loams, 2 to 5 percent slopes
KdC	Kadoka-Huggins silt loams, 5 to 9 percent slopes
KeA	Keith silt loam, 0 to 2 percent slopes
KeC	Keith silt loam, 2 to 9 percent slopes
KgD	Keith-Epping silt loams, 9 to 15 percent slopes
KhE	Keota-Epping silt loams, 9 to 21 percent slopes
KkD	Keota-Kadoka silt loams, 9 to 15 percent slopes
KrF	Keota-Rock outcrop complex, 16 to 40 percent slopes
Ky	Keya silt loam
La	Loamy alluvial land
Le	Loup-Elsmere loamy fine sands
MbA	Millboro silty clay, 0 to 2 percent slopes
MbB	Millboro silty clay, 2 to 5 percent slopes
MbC	Millboro silty clay, 5 to 9 percent slopes
MhA	Mosher silt loam, 0 to 4 percent slopes
MmA	Mosher-Minatare silt loams, 0 to 4 percent slopes
OkC	Okreek silty clay, 5 to 9 percent slopes
OoE	Okreek-Orella complex, 6 to 21 percent slopes
OrF	Orella-Rock outcrop complex, 15 to 40 percent slopes
Pm	Peaty muck
RcE	Richfield and Canyon soils, 9 to 21 percent slopes
RdA	Richfield-Dawes silt loams, 0 to 2 percent slopes
RhB	Richfield-Tuthill silt loams, 2 to 9 percent slopes
RnA	Ronson-Anselmo fine sandy loams, 0 to 3 percent slopes
RnB	Ronson-Anselmo fine sandy loams, 3 to 5 percent slopes
Ru	Rough broken land
Sa	Saline lowland
SbE	Samsil-Boyd clays, 19 to 30 percent slopes
Sd	Sandy alluvial land
SnC	Shena silt loam, 0 to 9 percent slopes
TcF	Tassel-Rock outcrop complex, 25 to 40 percent slopes
TfE	Tassel-Ronson fine sandy loams, 3 to 30 percent slopes
ThA	Tuthill silt loam, 0 to 3 percent slopes
ThB	Tuthill silt loam, 3 to 5 percent slopes
ThC	Tuthill silt loam, 5 to 9 percent slopes
TnC	Tuthill-Anselmo fine sandy loams, 3 to 9 percent slopes
TtC	Tuthill-Tassel fine sandy loams, 3 to 9 percent slopes
TvA	Tuthill-Vetal fine sandy loams, 0 to 3 percent slopes
TwA	Tuthill-Wortman fine sandy loams, 0 to 3 percent slopes
VaE	Valentine fine sand, 5 to 30 percent slopes
VdC	Valentine-Dunday complex, 3 to 9 percent slopes
VsE	Valentine-Tassel complex, 5 to 30 percent slopes
Vt	Vetal fine sandy loam
WbA	Wanblee-Wortman silt loams, 0 to 6 percent slopes
Wd	Wann sandy loam
We	Wann loam, depressional
WhA	Whitelake fine sandy loam, 0 to 3 percent slopes
WoA	Wortman fine sandy loam, 0 to 3 percent slopes
WrA	Wortman silt loam, 0 to 6 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. A technical description of a profile that is representative of the series is part of the series description. Facts about managing the range are provided on pages 46 to 50. Complete information about soil capability units is in the subsection "Management by Capability Units" pages 52 to 59. Management of tame pastures is described on pages 61 and 62. Use of the soils for wildlife is described on pages 65 to 67. Other information is in tables as follows:

Acreage and extent, table 1, page 11.
Predicted yields, table 2, page 59.

Windbreak groups, table 3, page 64.
Engineering uses of the soils, tables 4, 5, and 6, pages 68 to 83.

Map symbol	Mapping unit	Described on page	Range site: Name	Range site: Page	Capability unit: Symbol	Capability unit: Page	Pasture group: Symbol	Pasture group: Page	Windbreak group: Number	Windbreak group: Page
AlA	Altvan loam, 0 to 2 percent slopes-----	12	Silty	49	IIIs-2	55	D	61	6	63
AlB	Altvan loam, 2 to 5 percent slopes-----	12	Silty	49	IIIe-6	53	D	61	6	63
AnB	Anselmo fine sandy loam, 2 to 5 percent slopes----------	13	Sandy	49	IIIe-8	54	H	62	5	63
AnC	Anselmo fine sandy loam, 5 to 9 percent slopes----------	13	Sandy	49	IVe-8	56	H	62	5	63
ArC	Anselmo-Ronson fine sandy loams, 5 to 9 percent slopes----------	13								
	Anselmo part----------	--	Sandy	49	IVe-8	56	H	62	5	63
	Ronson part----------	--	Sandy	49	IVe-8	56	H	62	8	64
AtE	Anselmo-Tassel fine sandy loams, 9 to 21 percent slopes----------	13								
	Anselmo part----------	--	Sandy	49	VIe-6	57	---	--	10	64
	Tassel part----------	--	Shallow	50	VIe-10	58	---	--	10	64
AuE	Anselmo-Tuthill fine sandy loams, 9 to 21 percent slopes----------	14	Sandy	49	VIe-6	57	---	--	10	64
AvA	Anselmo-Vetal fine sandy loams, 0 to 2 percent slopes----------	14								
	Anselmo part----------	--	Sandy	49	IIIe-7	54	H	62	5	63
	Vetal part----------	--	Sandy	49	IIIe-7	54	H	62	1	62
BsD	Boyd-Samsil clays, 6 to 19 percent slopes----------	15								
	Boyd part----------	--	Clayey	49	VIe-4	57	I	62	10	64
	Samsil part----------	--	Shallow	50	VIs-3	58	---	--	10	64
CaA	Chappell-Anselmo fine sandy loams, 0 to 3 percent slopes----------	16								
	Chappell part----------	--	Sandy	49	IIIe-9	54	D	61	6	63
	Anselmo part----------	--	Sandy	49	IIIe-7	54	H	62	5	63
CaB	Chappell-Anselmo fine sandy loams, 3 to 5 percent slopes----------	16								
	Chappell part----------	--	Sandy	49	IIIe-10	54	D	61	6	63
	Anselmo part----------	--	Sandy	49	IIIe-8	54	H	62	5	63
DcC	Dix-Chappell fine sandy loams, 3 to 9 percent slopes----------	17								
	Dix part----------	--	Shallow to Gravel	50	VIs-4	58	---	--	10	64
	Chappell part----------	--	Sandy	49	IIIe-10	54	D	61	6	63
DfA	Doger loamy fine sand, 0 to 3 percent slopes----------	18	Sandy	49	IVe-9	56	H	62	5	63
DgB	Doger-Dunday loamy fine sands, 3 to 6 percent slopes----------	18								
	Doger part----------	--	Sandy	49	IVe-9	56	H	62	5	63
	Dunday part----------	--	Sands	48	VIe-7	57	---	--	7	64
DlB	Duda loamy fine sand, 0 to 6 percent slopes----------	18	Sands	48	IVe-9	56	H	62	7	64
DsA	Dunday loamy fine sand, 0 to 2 percent slopes----------	19	Sands	48	IVe-9	56	H	62	7	64
DuA	Dunday fine sandy loam, 0 to 2 percent slopes----------	19	Sandy	49	IVe-9	56	H	62	7	64
ElA	Elsmere loamy fine sand, 0 to 3 percent slopes----------	20	Subirrigated	47	IVe-10	56	A	61	2	62
Ge	Gannett sandy loam----------	20	Wetland	47	Vw-3	57	B	61	10	64
Gh	Goshen silt loam----------	21	Overflow	47	IIc-3	53	K	62	1	62
Gr	Gravelly land----------	21	Very Shallow	50	VIIs-4	59	---	--	10	64
HfA	Holt fine sandy loam, 0 to 3 percent slopes----------	22	Sandy	49	IIIe-9	54	H	62	5	63
HlC	Holt-Vetal fine sandy loams, 3 to 9 percent slopes----------	22								
	Holt part----------	--	Sandy	49	IVe-8	56	H	62	5	63
	Vetal part----------	--	Sandy	49	IIIe-8	54	H	62	1	62
HmA	Hoven silt loam, 0 to 1 percent slopes----	23	Closed Depression	48	VIs-1	58	B	61	10	64
HnA	Hoven silt loam, drained, 0 to 5 percent slopes----------	23	Thin Claypan	50	VIs-1	58	---	--	10	64
HuA	Huggins silt loam, 0 to 2 percent slopes--	24	Clayey	49	IIIs-5	55	E	61	4	63
HwB	Huggins-Kadoka silt loams, 2 to 9 percent slopes----------	25								
	Huggins part----------	--	Clayey	49	IVe-3	55	E	61	4	63
	Kadoka part----------	--	Silty	49	IIe-1	52	F	61	3	63
KaA	Kadoka silt loam, 0 to 2 percent slopes---	25	Silty	49	IIc-2	53	F	61	3	63
KbC	Kadoka-Epping silt loams, 5 to 9 percent slopes----------	25								
	Kadoka part----------	--	Silty	49	IIIe-1	53	F	61	3	63
	Epping part----------	--	Shallow	50	VIs-2	58	---	--	10	64
KdB	Kadoka-Huggins silt loams, 2 to 5 percent slopes----------	26								
	Kadoka part----------	--	Silty	49	IIe-1	52	F	61	3	63
	Huggins part----------	--	Clayey	49	IIIe-12	54	E	61	4	63
KdC	Kadoka-Huggins silt loams, 5 to 9 percent slopes----------	26								
	Kadoka part----------	--	Silty	49	IIIe-1	53	F	61	3	63
	Huggins part----------	--	Clayey	49	IVe-3	55	E	61	4	63
KeA	Keith silt loam, 0 to 2 percent slopes----	27	Silty	49	IIc-2	53	F	61	3	63
KeC	Keith silt loam, 2 to 9 percent slopes----	27	Silty	49	IIIe-1	53	F	61	3	63
KgD	Keith-Epping silt loams, 9 to 15 percent slopes----------	27								
	Keith part----------	--	Silty	49	IVe-1	55	F	61	3	63
	Epping part----------	--	Shallow	50	VIs-2	58	---	--	10	64
KhE	Keota-Epping silt loams, 9 to 21 percent slopes----------	28								
	Keota part----------	--	Thin Upland	49	VIe-3	57	---	--	10	64
	Epping part----------	--	Shallow	50	VIs-2	58	---	--	10	64
KkD	Keota-Kadoka silt loams, 9 to 15 percent slopes----------	28								
	Keota part----------	--	Thin Upland	49	VIe-3	57	F	61	10	64
	Kadoka part----------	--	Silty	49	IVe-1	55	F	61	3	63
KrF	Keota-Rock outcrop complex, 16 to 40 percent slopes----------	28								
	Keota part----------	--	Thin Upland	49	VIIe-3	58	---	--	10	64
	Rock outcrop part----------	--	----------	--	VIIIs-1	59	---	--	--	--
Ky	Keya silt loam----------	29	Overflow	47	IIc-3	53	K	62	1	62
La	Loamy alluvial land----------	29	Overflow	47	VIw-3	58	---	--	10	64
Le	Loup-Elsmere loamy fine sands----------	29								
	Loup part----------	--	Subirrigated	47	Vw-3	57	B	61	10	64
	Elsmere part----------	--	Subirrigated	47	IVe-10	56	A	61	2	62
MbA	Millboro silty clay, 0 to 2 percent slopes----------	30	Clayey	49	IIIs-3	55	I	62	4	63

465-344 O - 74 (Face mar.

Map symbol	Mapping unit	Described on page	Range site: Name	Range site: Page	Capability unit: Symbol	Capability unit: Page	Pasture group: Symbol	Pasture group: Page	Windbreak group: Number	Windbreak group: Page
MbB	Millboro silty clay, 2 to 5 percent slopes	30	Clayey	49	IIIe-4	53	I	62	4	63
MbC	Millboro silty clay, 5 to 9 percent slopes	30	Clayey	49	IVe-4	56	I	62	4	63
MhA	Mosher silt loam, 0 to 4 percent slopes	31	Claypan	50	IVs-2	57	C	61	9	64
MmA	Mosher-Minatare silt loams, 0 to 4 percent slopes	32								
	Mosher part	--	Claypan	50	IVs-2	57	C	61	9	64
	Minatare part	--	Thin Claypan	50	VIs-1	58	---	--	10	64
OkC	Okreek silty clay, 5 to 9 percent slopes	32	Clayey	49	IVe-4	56	I	62	4	63
OoE	Okreek-Orella complex, 6 to 21 percent slopes	32								
	Okreek part	--	Clayey	49	VIe-4	57	I	62	10	64
	Orella part	--	Shallow	50	VIs-3	58	---	--	10	64
OrF	Orella-Rock outcrop complex, 15 to 40 percent slopes	33								
	Orella part	--	Shallow	50	VIIs-2	58	---	--	10	64
	Rock outcrop part	--	----------	--	VIIIs-1	59	---	--	--	--
Pm	Peaty muck	33	Wetland	47	Vw-3	57	---	--	10	64
RcE	Richfield and Canyon soils, 9 to 21 percent slopes	34								
	Richfield part	--	Silty	49	VIe-1	57	F	61	10	64
	Canyon part	--	Shallow	50	VIs-2	58	---	--	10	64
RdA	Richfield-Dawes silt loams, 0 to 2 percent slopes	34								
	Richfield part	--	Silty	49	IIc-2	53	F	61	3	63
	Dawes part	--	Clayey	49	IIs-1	52	E	61	4	63
RhB	Richfield-Tuthill silt loams, 2 to 9 percent slopes	35	Silty	49	IIIe-1	53	F	61	3	63
RnA	Ronson-Anselmo fine sandy loams, 0 to 3 percent slopes	35								
	Ronson part	--	Sandy	49	IIIe-9	54	H	62	8	64
	Anselmo part	--	Sandy	49	IIIe-7	54	H	62	5	63
RnB	Ronson-Anselmo fine sandy loams, 3 to 5 percent slopes	35								
	Ronson part	--	Sandy	49	IIIe-10	54	H	62	8	64
	Anselmo part	--	Sandy	49	IIIe-8	54	H	62	5	63
Ru	Rough broken land	36	Savannah	48	VIIs-6	59	---	--	10	64
Sa	Saline lowland	36	Saline Lowland	47	VIIs-5	59	---	--	10	64
SbE	Samsil-Boyd clays, 19 to 30 percent slopes	37								
	Samsil part	--	Shallow	50	VIIs-2	58	---	--	10	64
	Boyd part	--	Clayey	49	VIe-4	57	---	--	10	64
Sd	Sandy alluvial land	37	Overflow	47	VIw-3	58	---	--	10	64
SnC	Shena silt loam, 0 to 9 percent slopes	37	Shallow	50	VIs-2	58	---	--	10	64
TcF	Tassel-Rock outcrop complex, 25 to 40 percent slopes	39								
	Tassel part	--	Shallow	50	VIIe-4	58	---	--	10	64
	Rock outcrop part	--	----------	--	VIIIs-1	59	---	--	--	--
TfE	Tassel-Ronson fine sandy loams, 3 to 30 percent slopes	39								
	Tassel part	--	Shallow	50	VIIe-4	58	---	--	10	64
	Ronson part	--	Sandy	49	VIe-6	57	---	--	10	64
ThA	Tuthill silt loam, 0 to 3 percent slopes	40	Silty	49	IIc-2	53	F	61	3	63
ThB	Tuthill silt loam, 3 to 5 percent slopes	41	Silty	49	IIe-1	52	F	61	3	63
ThC	Tuthill silt loam, 5 to 9 percent slopes	41	Silty	49	IIIe-1	53	F	61	3	63
TnC	Tuthill-Anselmo fine sandy loams, 3 to 9 percent slopes	41								
	Tuthill part	--	Sandy	49	IVe-8	56	H	62	5	63
	Anselmo part	--	Sandy	49	IIIe-8	54	H	62	5	63
TtC	Tuthill-Tassel fine sandy loams, 3 to 9 percent slopes	41								
	Tuthill part	--	Sandy	49	IVe-8	56	H	62	5	63
	Tassel part	--	Shallow	50	VIe-10	58	---	--	10	64
TvA	Tuthill-Vetal fine sandy loams, 0 to 3 percent slopes	41								
	Tuthill part	--	Sandy	49	IIIe-7	54	H	62	5	63
	Vetal part	--	Sandy	49	IIIe-7	54	H	62	1	62
TwA	Tuthill-Wortman fine sandy loams, 0 to 3 percent slopes	42								
	Tuthill part	--	Sandy	49	IIIe-7	54	H	62	5	63
	Wortman part	--	Sandy	49	IVe-13	56	H	62	9	64
VaE	Valentine fine sand, 5 to 30 percent slopes	42	Sands	48	VIe-7	57	---	--	7	64
VdC	Valentine-Dunday complex, 3 to 9 percent slopes	42	Sands	48	VIe-7	57	---	--	7	64
VsE	Valentine-Tassel complex, 5 to 30 percent slopes	42								
	Valentine part	--	Sands	48	VIe-7	57	---	--	7	64
	Tassel part	--	Shallow	50	VIIe-4	58	---	--	10	64
Vt	Vetal fine sandy loam	43	Sandy	49	IIIe-7	54	H	62	1	62
WbA	Wanblee-Wortman silt loams, 0 to 6 percent slopes	44								
	Wanblee part	--	Thin Claypan	50	VIs-1	58	---	--	10	64
	Wortman part	--	Claypan	50	IVs-2	57	C	61	9	64
Wd	Wann sandy loam	44	Subirrigated	47	IIIw-5	55	A	61	2	62
We	Wann loam, depressional	44	Subirrigated	47	IIIw-5	55	A	61	2	62
WhA	Whitelake fine sandy loam, 0 to 3 percent slopes	45	Sandy	49	IVe-13	56	H	62	5	63
WoA	Wortman fine sandy loam, 0 to 3 percent slopes	46	Sandy	49	IVe-13	56	H	62	9	64
WrA	Wortman silt loam, 0 to 6 percent slopes	46	Claypan	50	IVs-2	57	C	61	9	64

465-344 O - 74 (Face map) No. 1

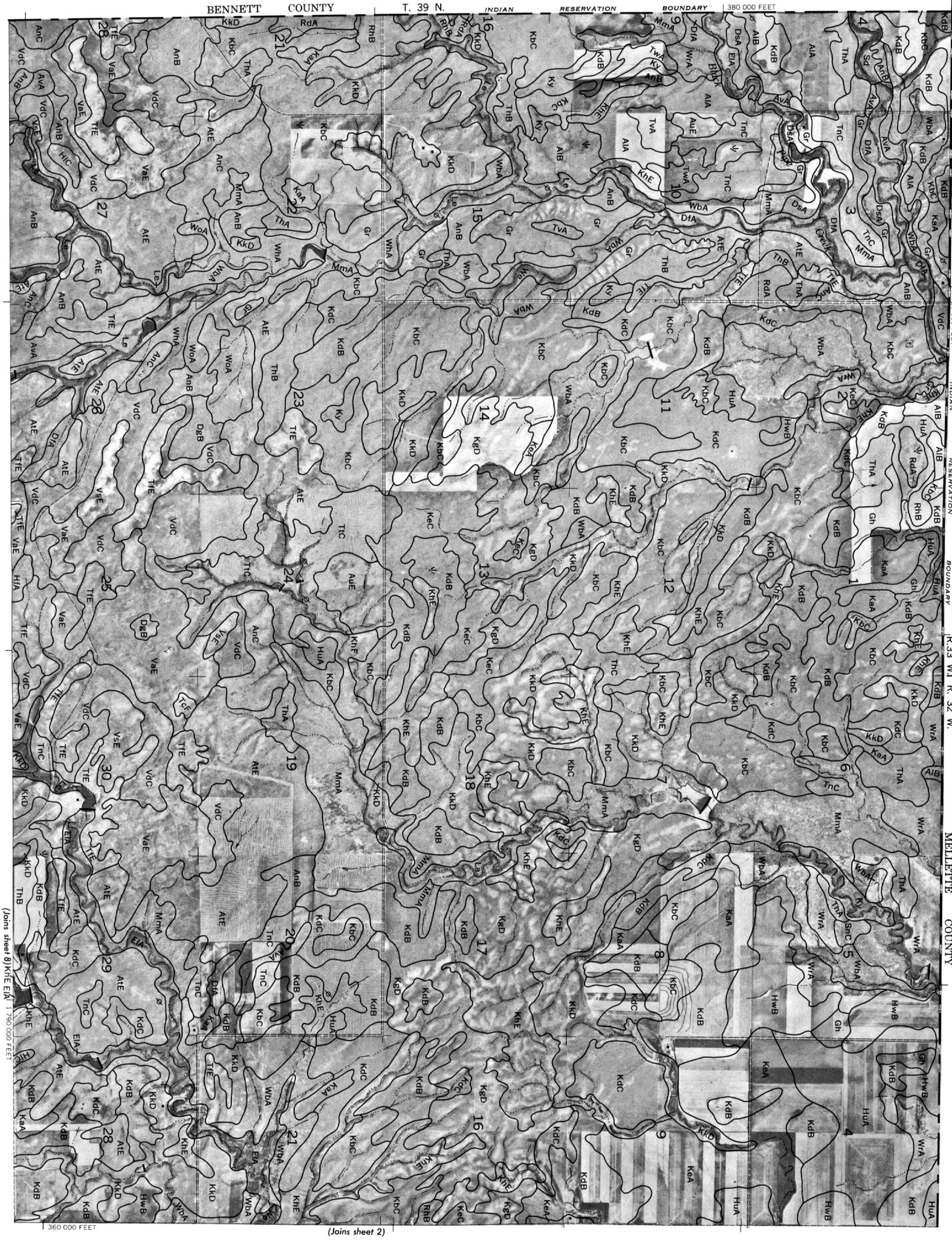
TODD COUNTY, SOUTH DAKOTA NO. 1

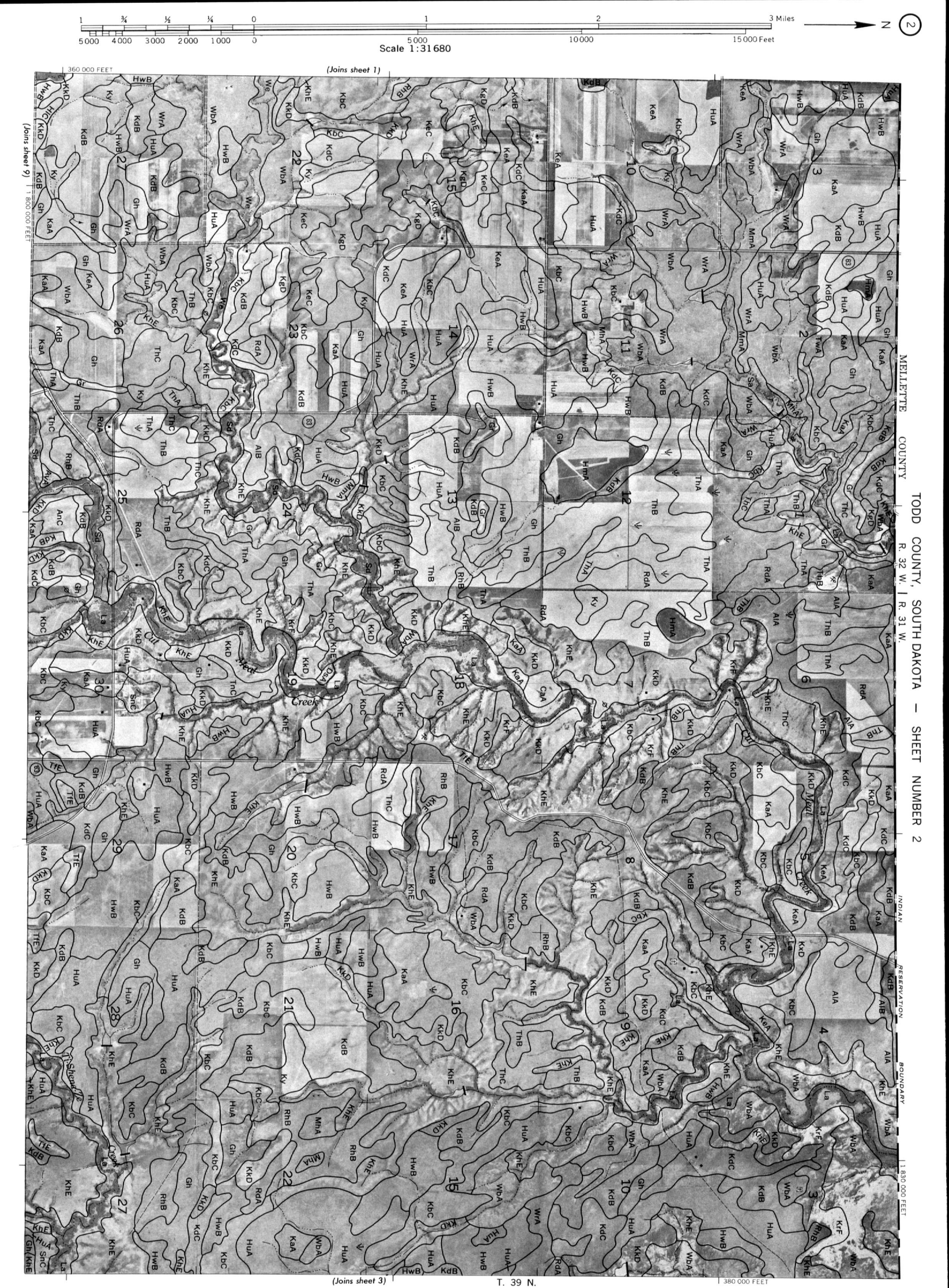
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.





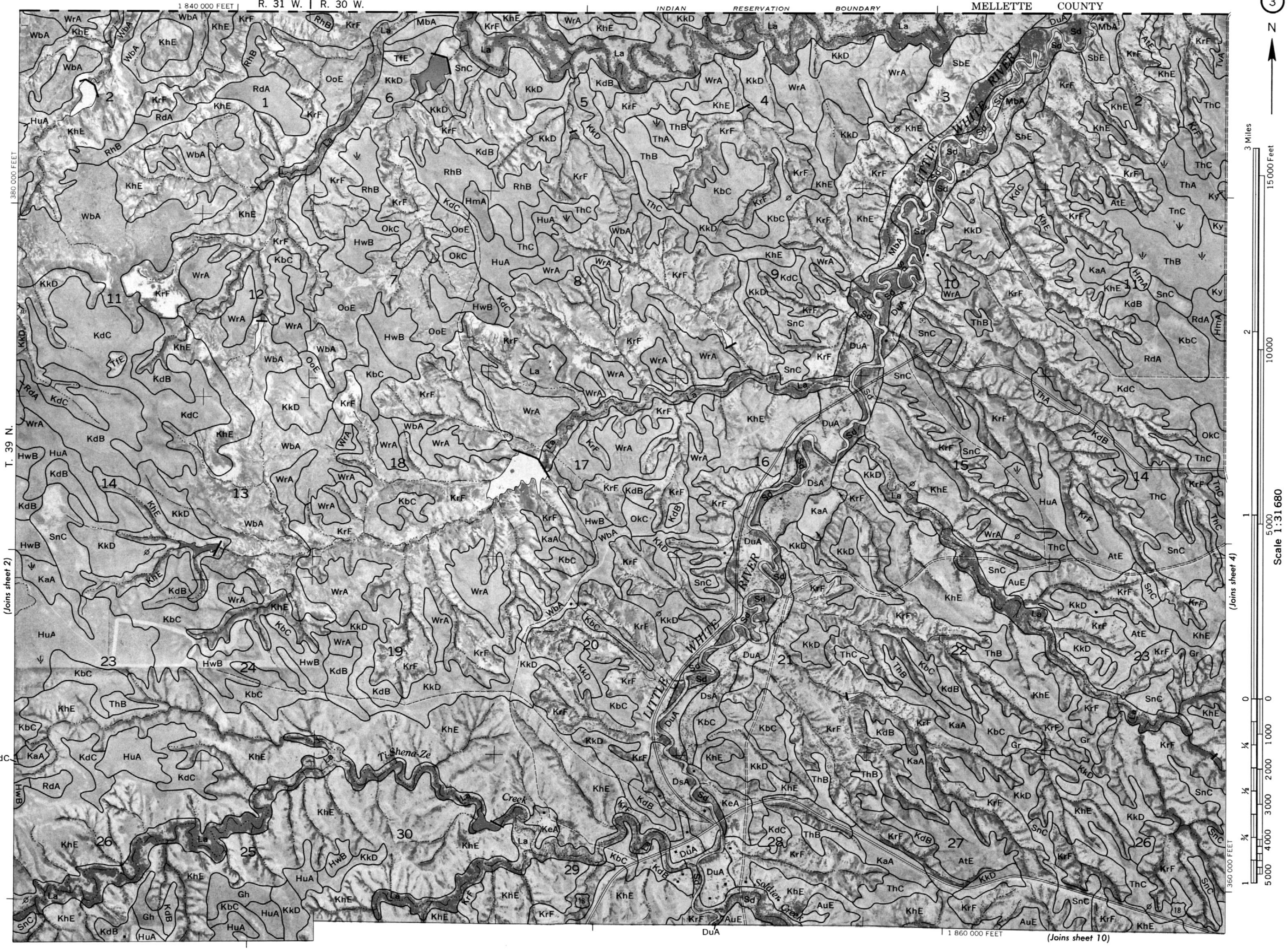
The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 2



TODD COUNTY, SOUTH DAKOTA NO. 3

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

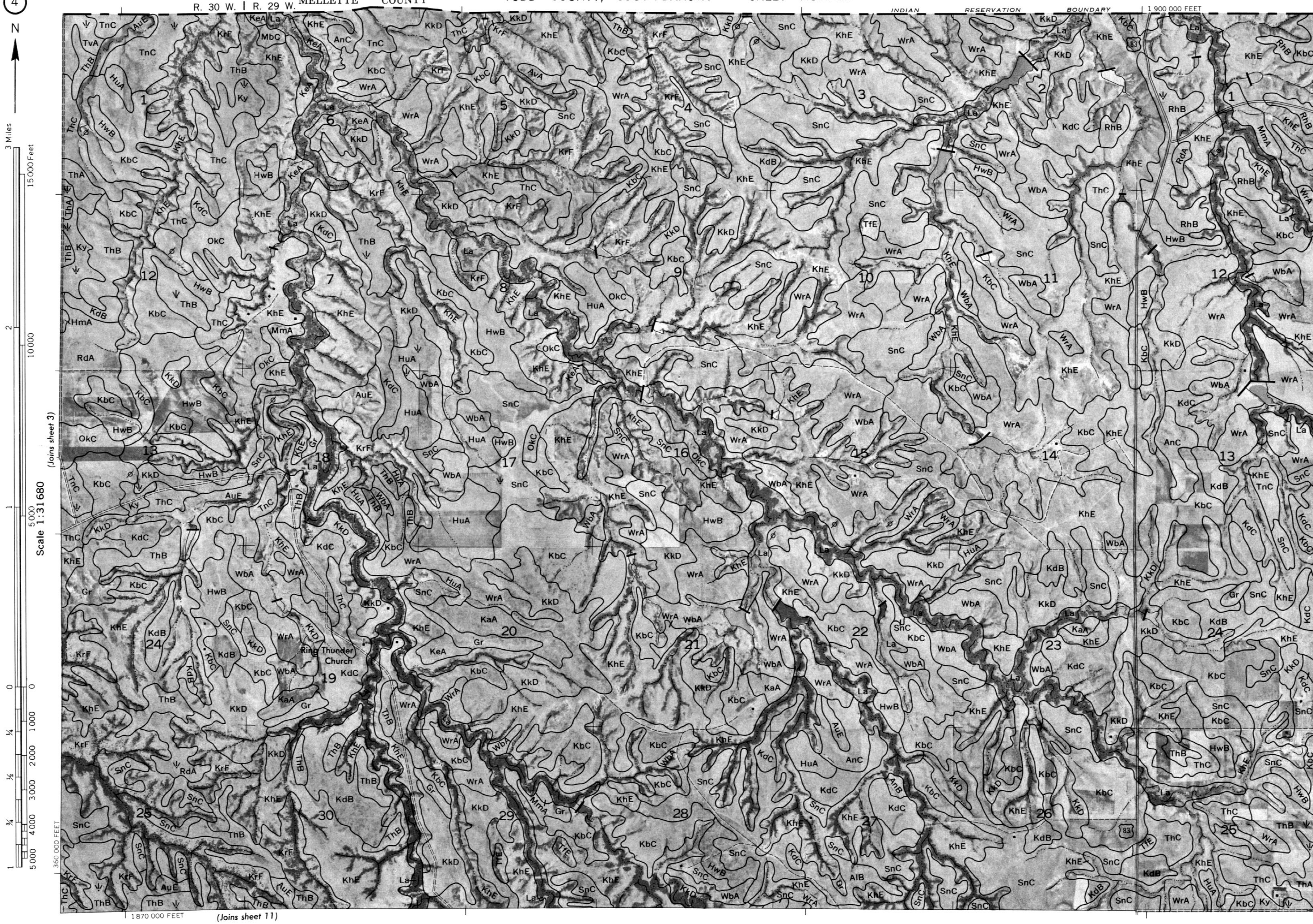
Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

(4)

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 4



The area shown on this map sheet is part of the Rosebud Indian Reservation.

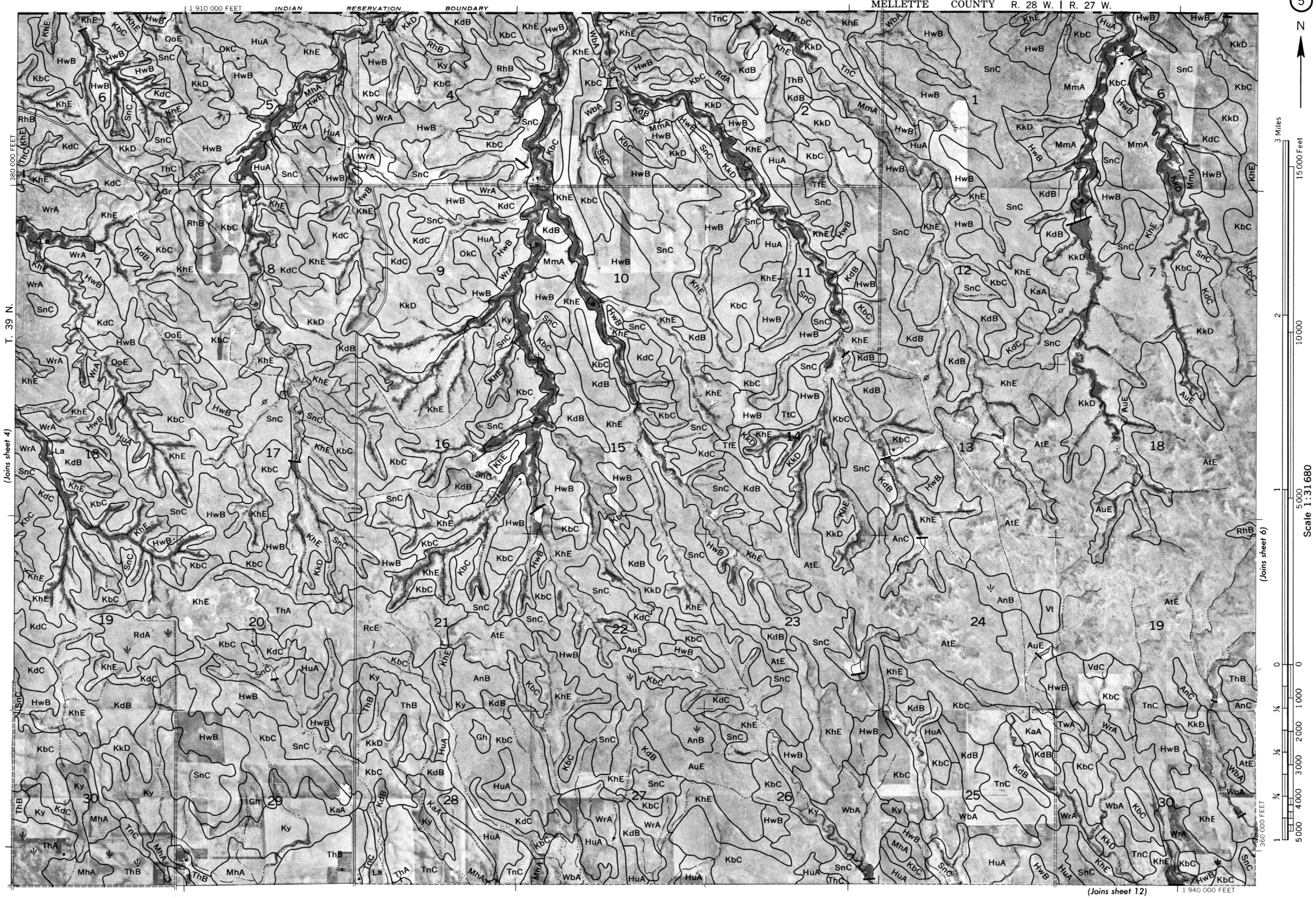
Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 4

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 5



TODD COUNTY, SOUTH DAKOTA NO. 5

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

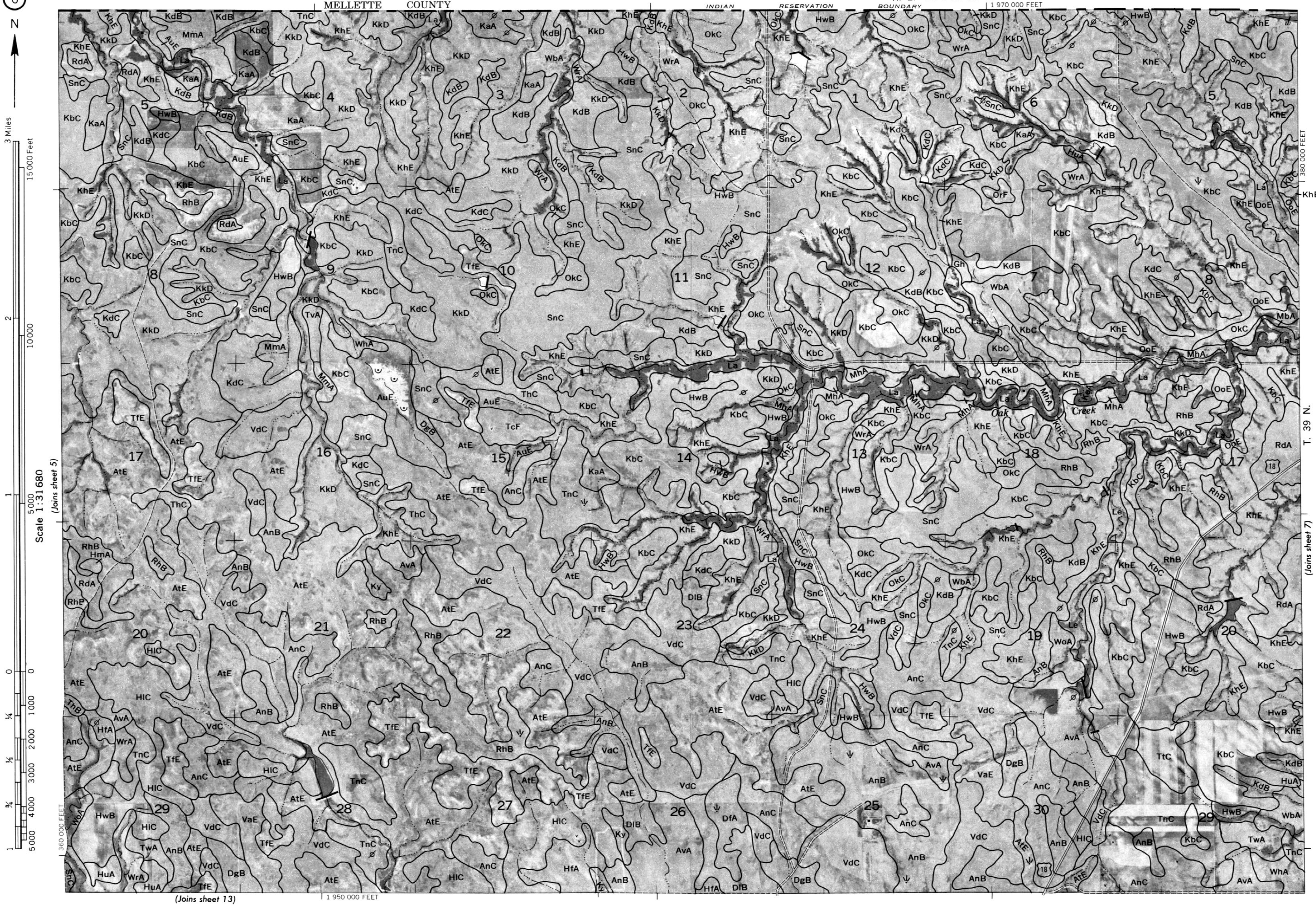
Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

6

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 6

R. 27 W. | R. 26 W.



The area shown on this map sheet is part of the Rosebud Indian Reservation.

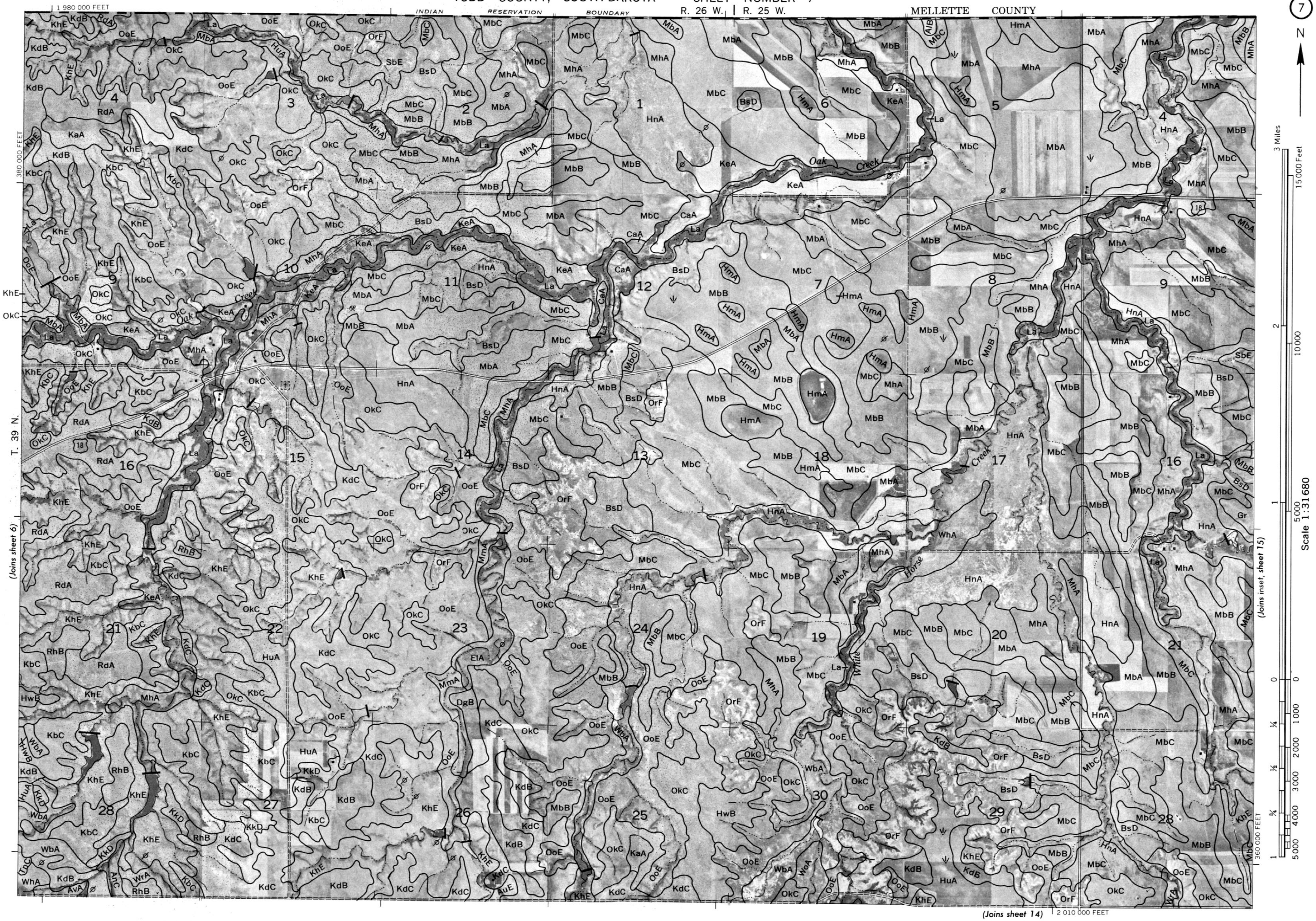
Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 6

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 7



TODD COUNTY, SOUTH DAKOTA NO. 7

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 8

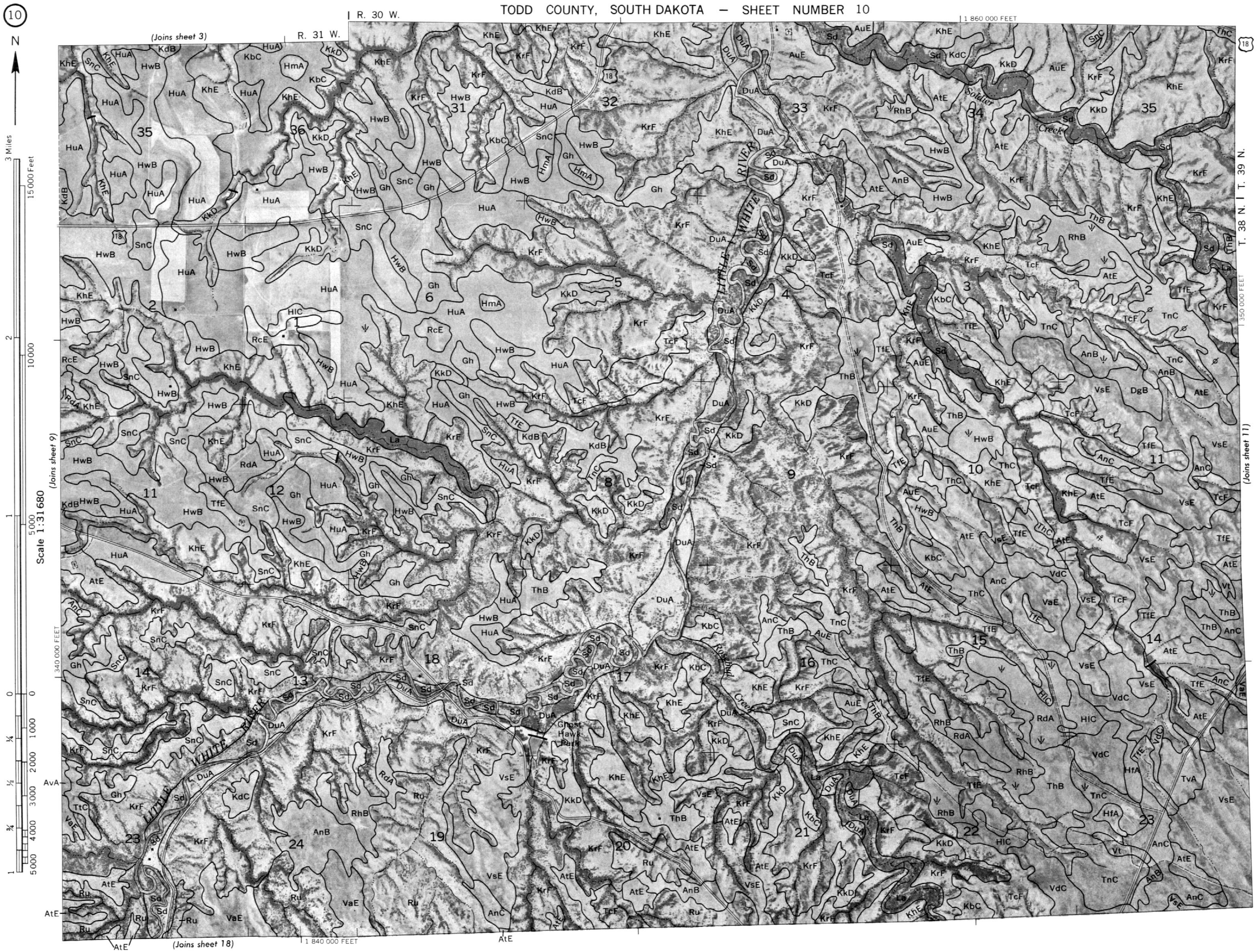
TODD COUNTY, SOUTH DAKOTA NO. 9

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



The area shown on this map sheet is part of the Rosebud Indian Reservation.
Land division corners are approximately positioned on this map.
Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 11

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

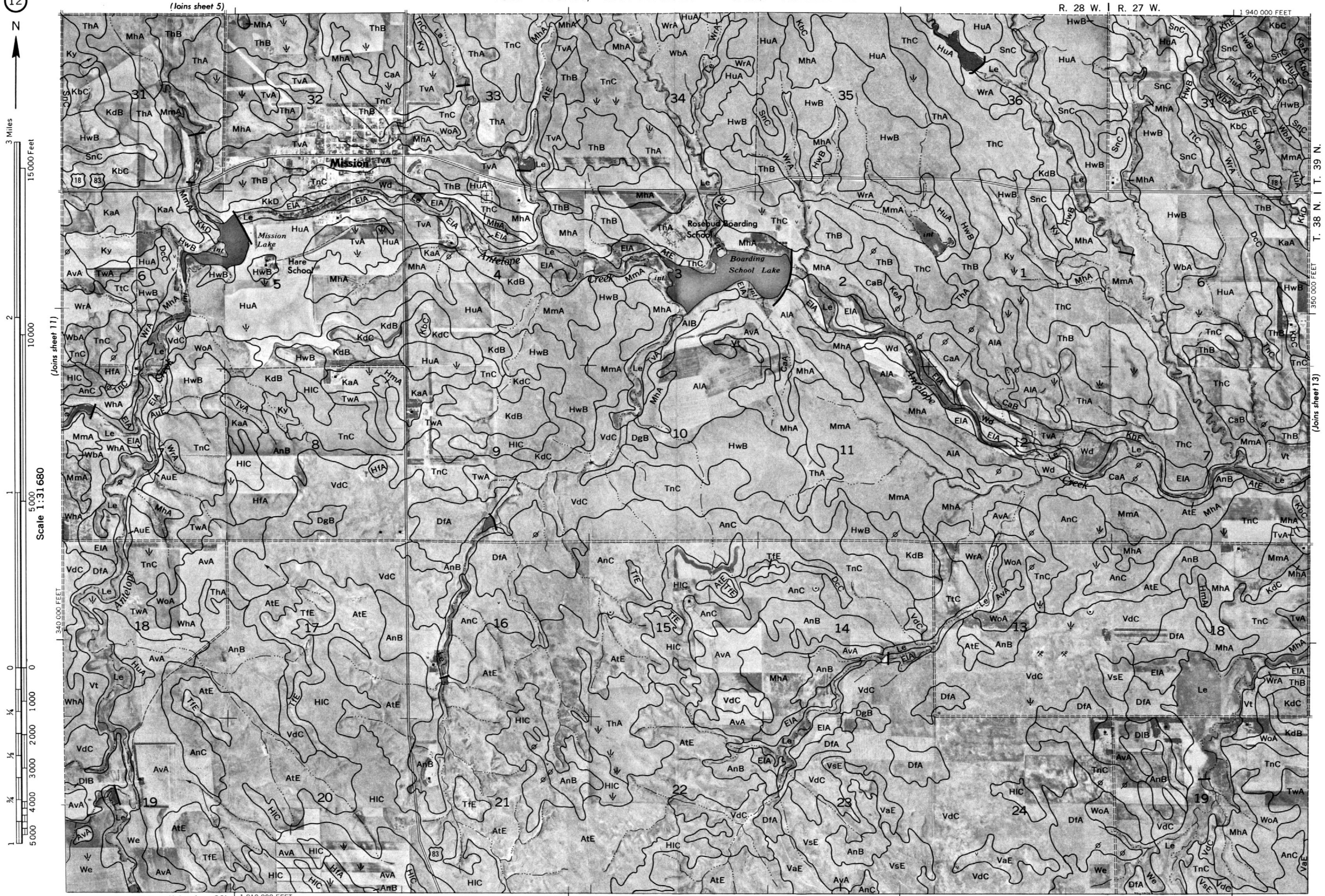
1 ¾ ½ ¼ 0 1 2 3 Miles

5000 4000 3000 2000 1000 0 5000 10000 15 000 Feet

Scale 1:31680

N

11



The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 12

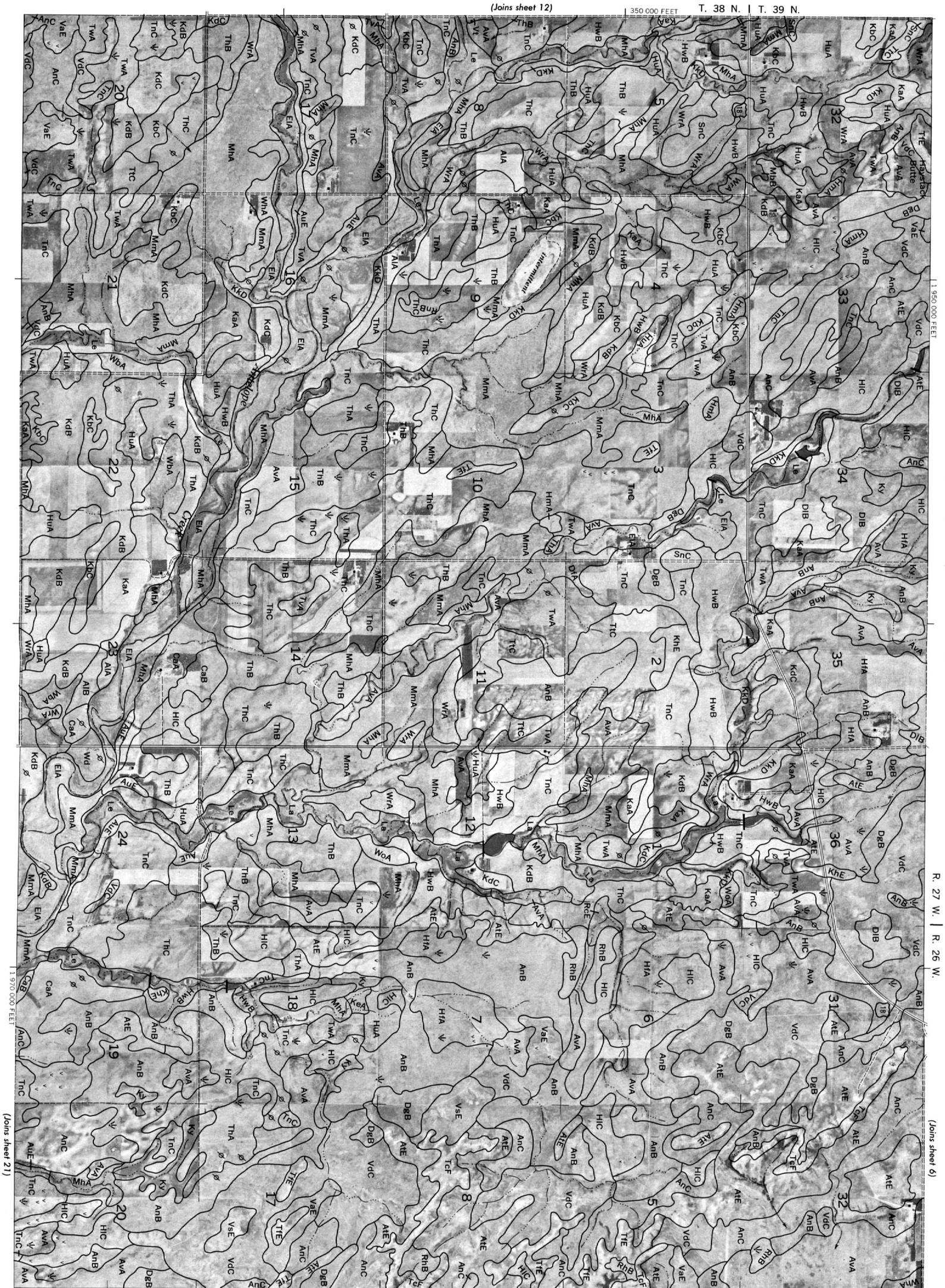
TODD COUNTY, SOUTH DAKOTA NO. 13

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 14

(14)

N

R. 26 W. | R. 25 W.

T. 38 N. | T. 39 N.

2 010 000 FEET

1 980 000 FEET

340 000 FEET

350 000 FEET

(Joins sheet 7)

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 22)

3 Miles 2 1 0 15000 Feet 10000 5000

Scale 1:31 680

1 ¾ ½ ¼ 0 0 1000 2000 3000 4000 5000

The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 14

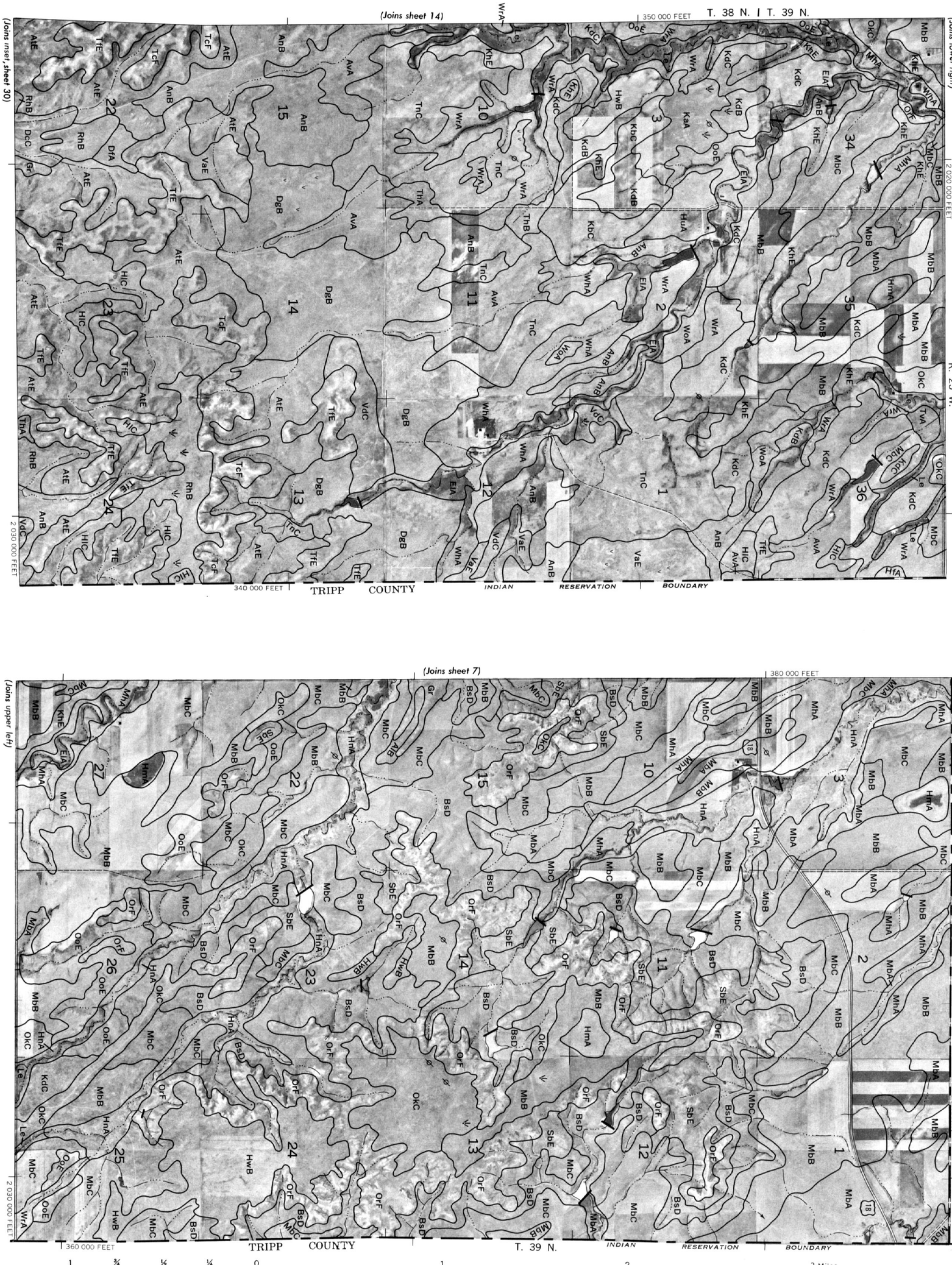
TODD COUNTY, SOUTH DAKOTA NO. 15

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

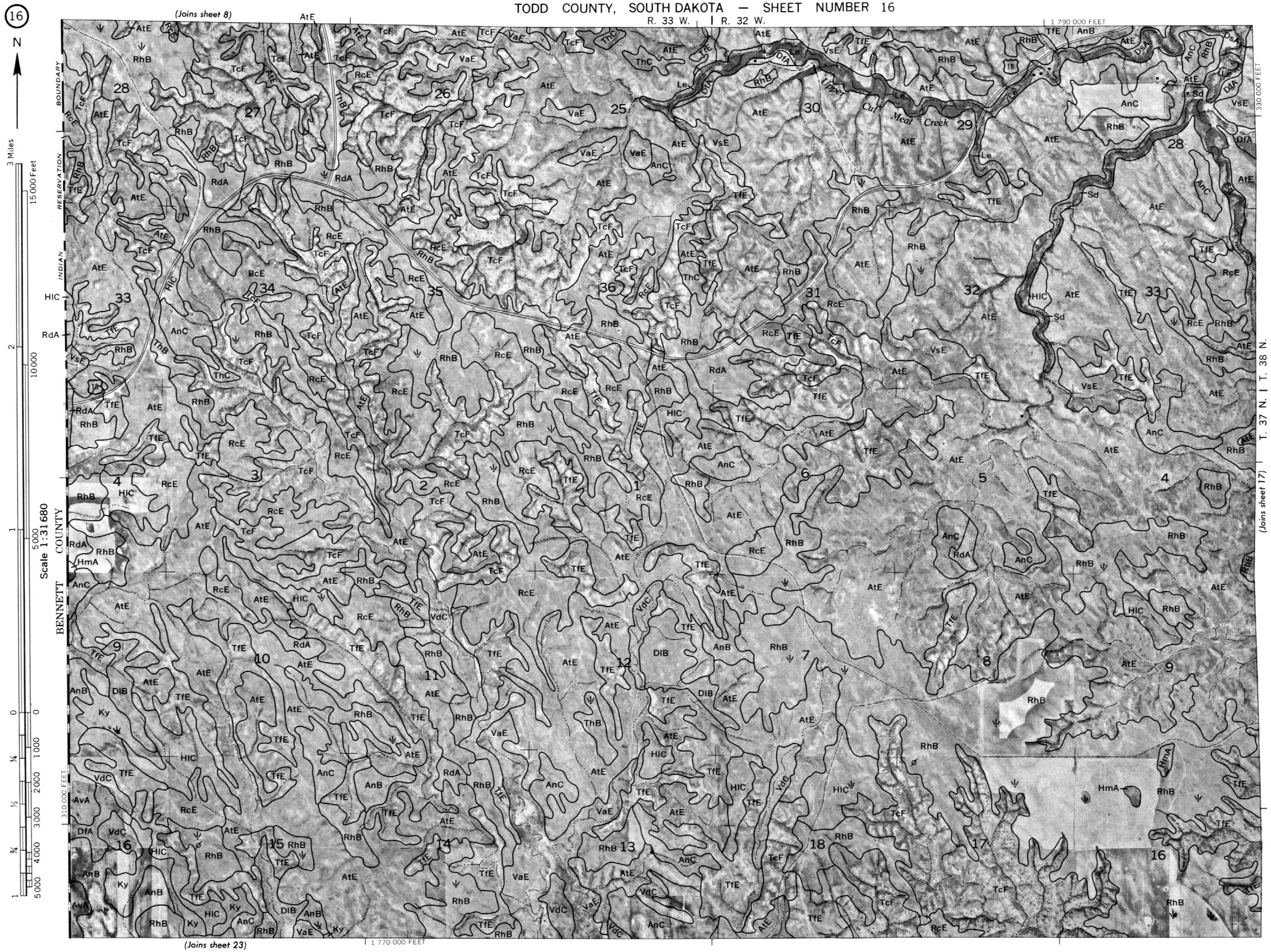


TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 15

MELLETTE COUNTY

15

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 16



The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 16

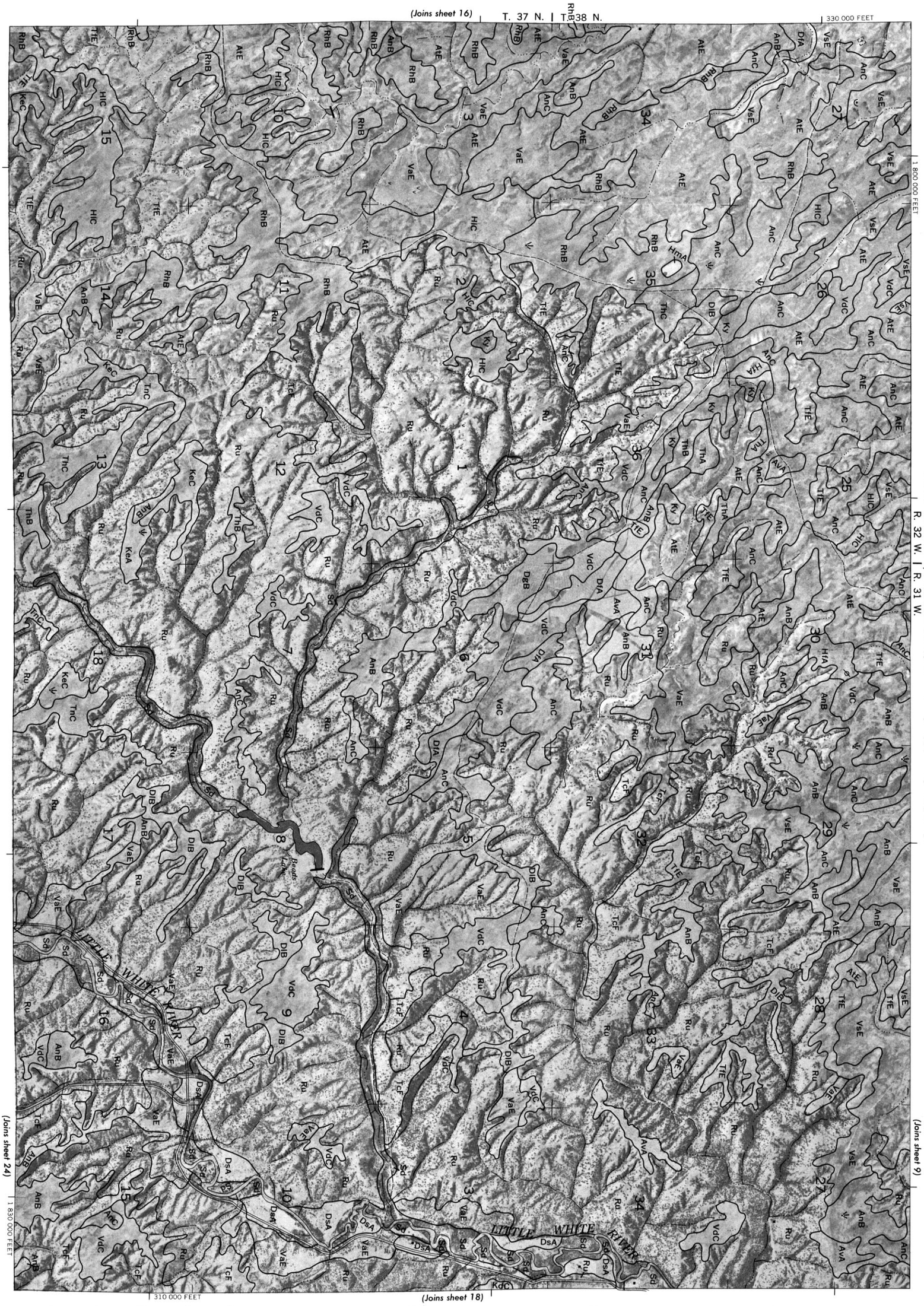
TODD COUNTY, SOUTH DAKOTA NO. 17

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 17

R. 32 W. | R. 31 W.

1 ¾ ½ ¼ 0 1 2 3 Miles

5000 4000 3000 2000 1000 0 5000 10000 15000 Feet

Scale 1:31680

N

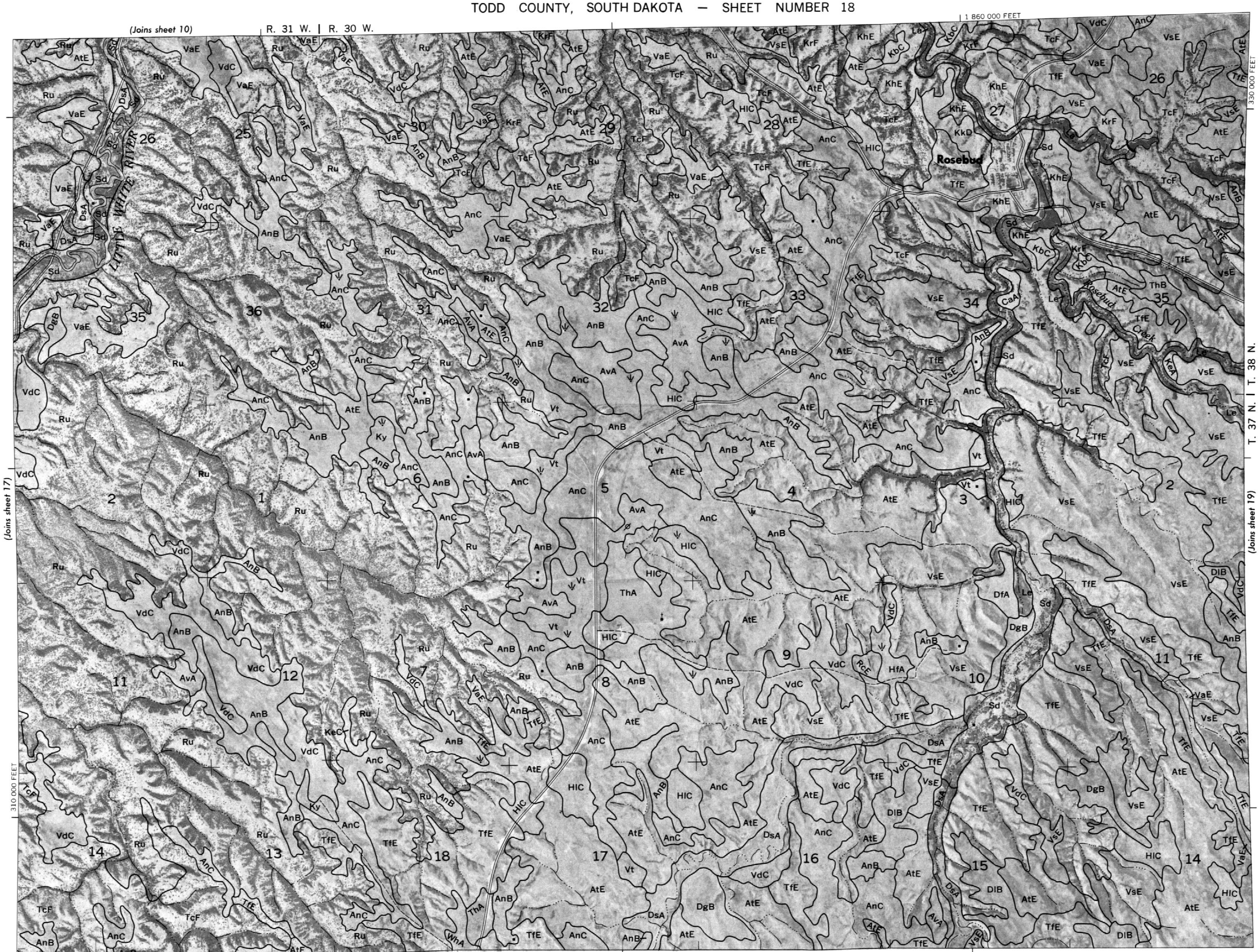
17

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 18

(Joins sheet 10)

R. 31 W. | R. 30 W.

1 860 000 FEET



(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 25)

N

Scale 1:31 680

3 Miles — 2 — 1 — 0 — ¼ — ½ — ¾ — 1

15 000 Feet — 10000 — 5 000 — 0 — 1000 — 2000 — 3000 — 4000 — 5000

The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

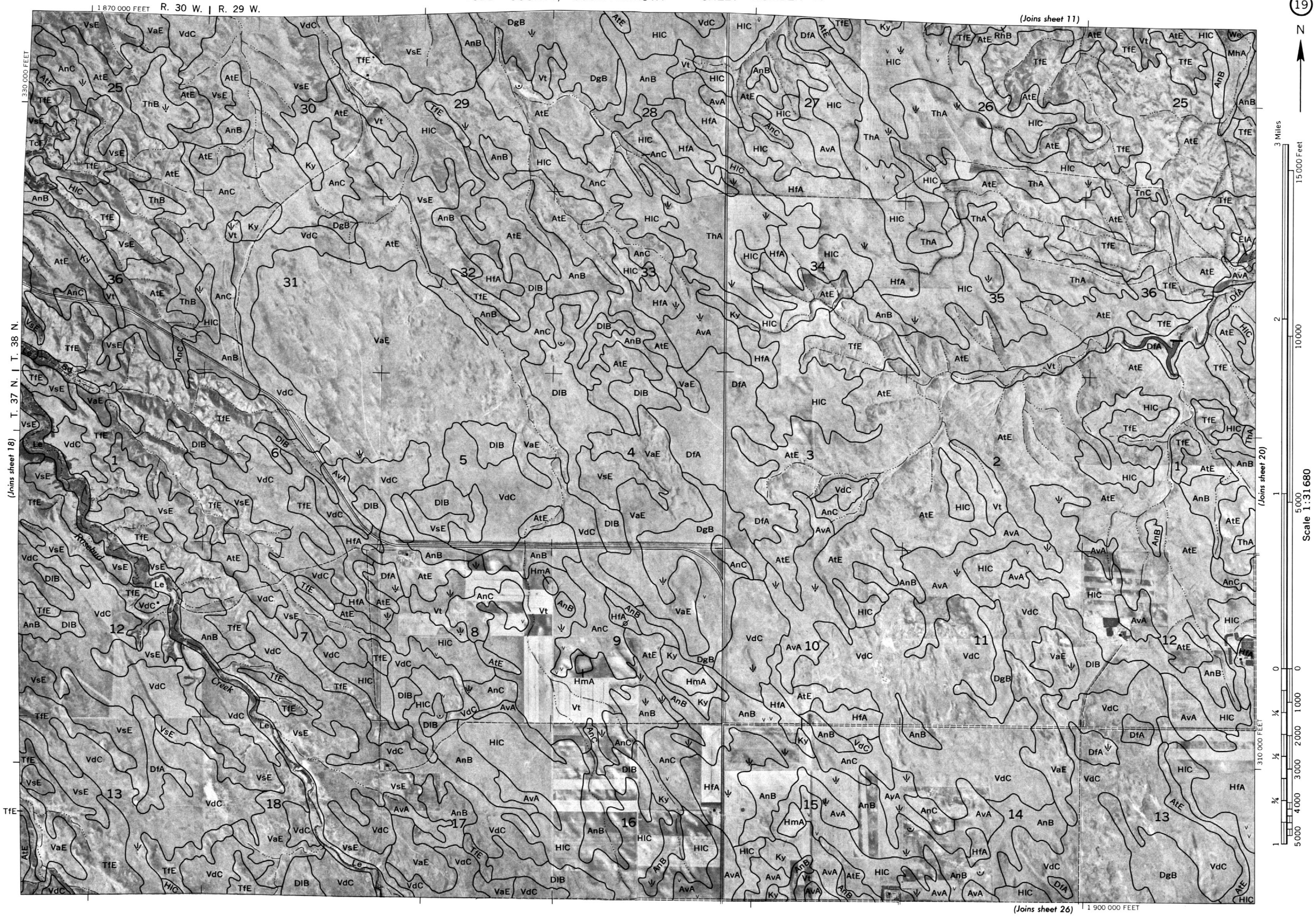
TODD COUNTY, SOUTH DAKOTA NO. 19

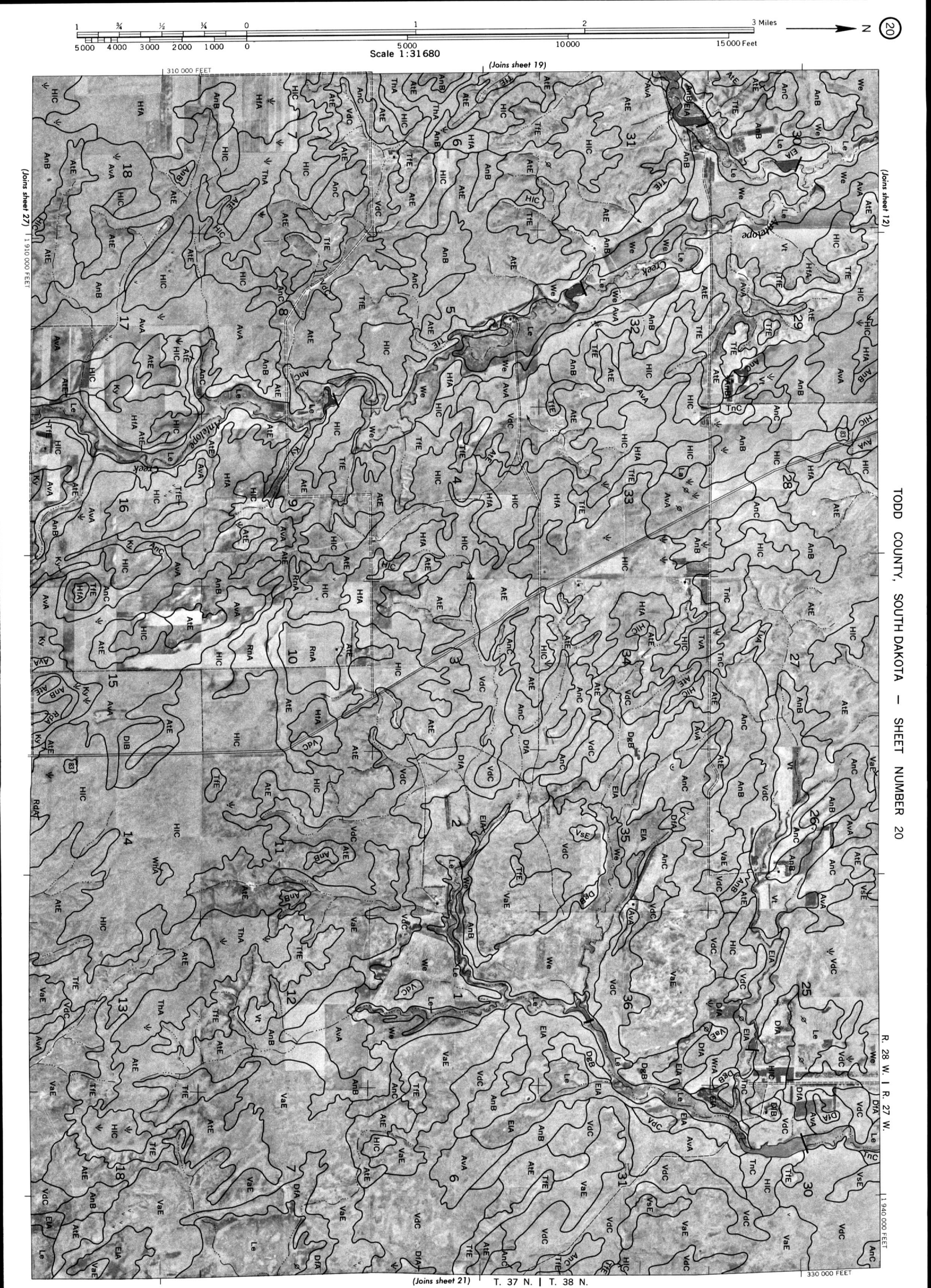
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.





The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 20

(21)

TODD COUNTY, SOUTH DAKOTA NO. 21

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 22

22

N

(Joins sheet 14)

R. 26 W. | R. 25 W.

2 010 000 FEET

330 000 FEET

T. 37 N. | T. 38 N.

3 Miles 2 1 0

15000 Feet 10000 5000

Scale 1:31 680

5000 4000 3000 2000 1000 0 5000

1 ¾ ½ ¼ 0

310 000 FEET

1 980 000 FEET

(Joins sheet 21)

(Joins sheet 29)

(Joins inset, sheet 30)

Keya Paha River

Antelope Creek

Rock Creek

The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 22

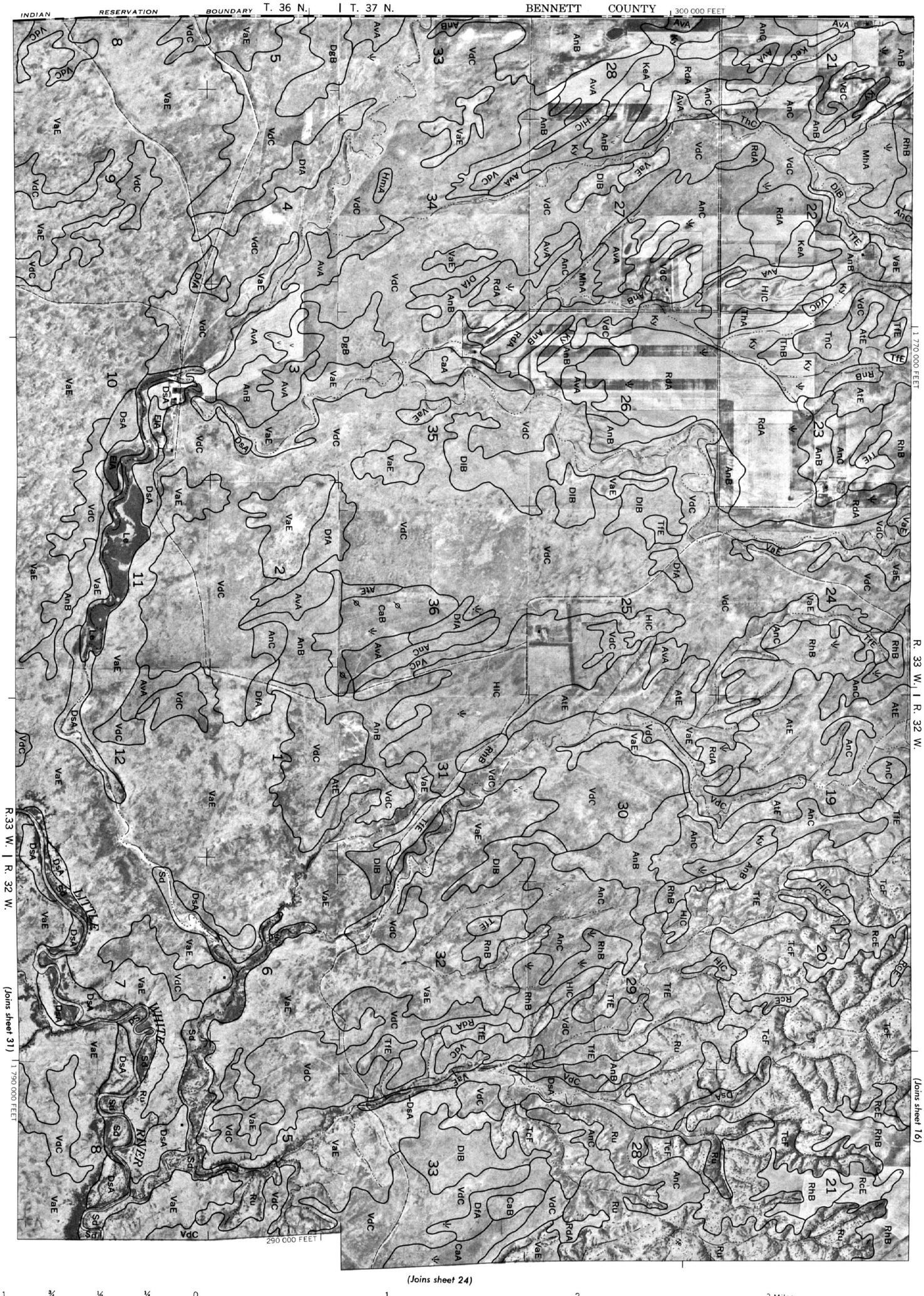
TODD COUNTY, SOUTH DAKOTA NO. 23

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



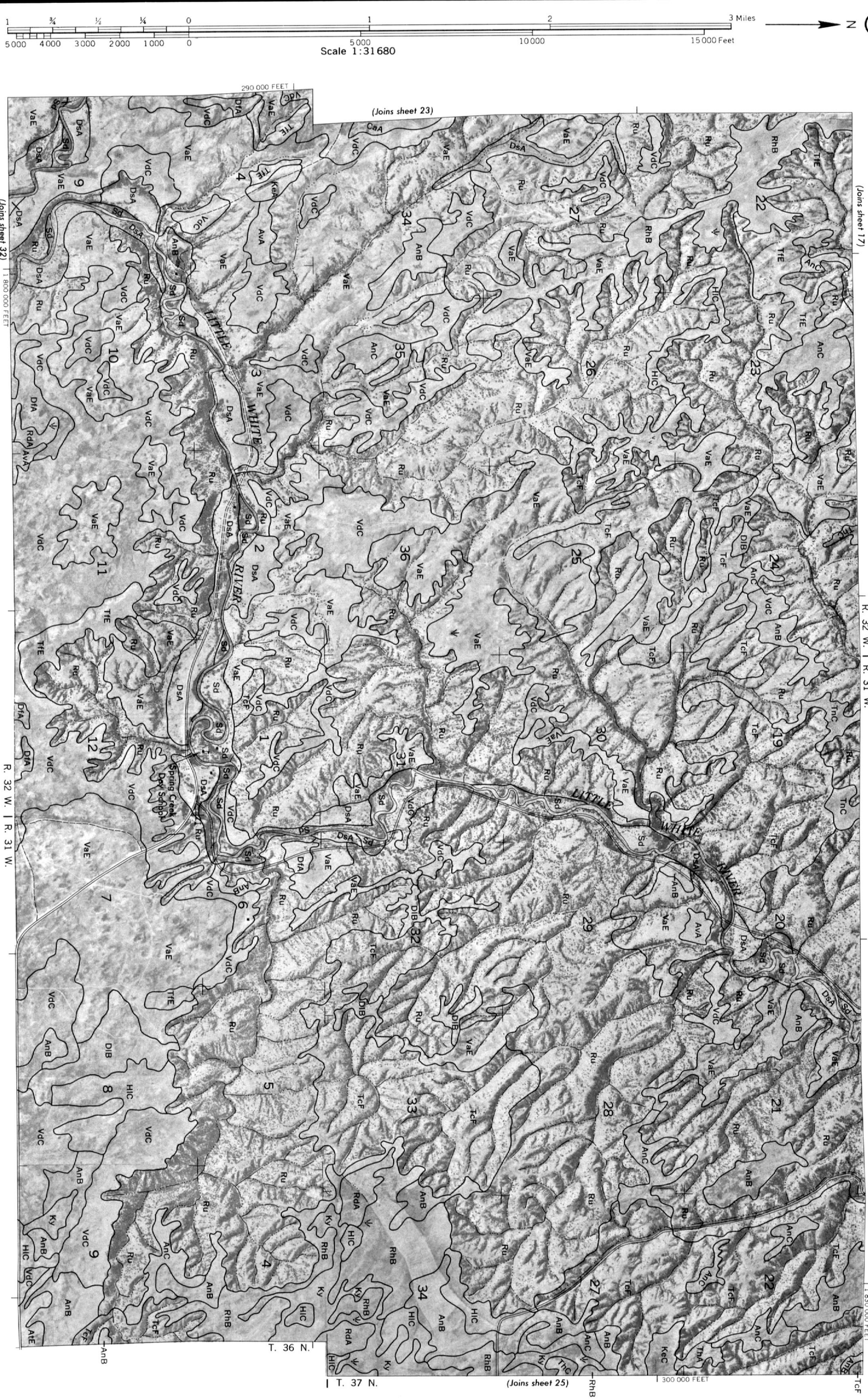
TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 23

1 ¾ ½ ¼ 0 1 2 3 Miles

5000 4000 3000 2000 1000 0 5000 10000 15000 Feet

Scale 1:31680

N



The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 24

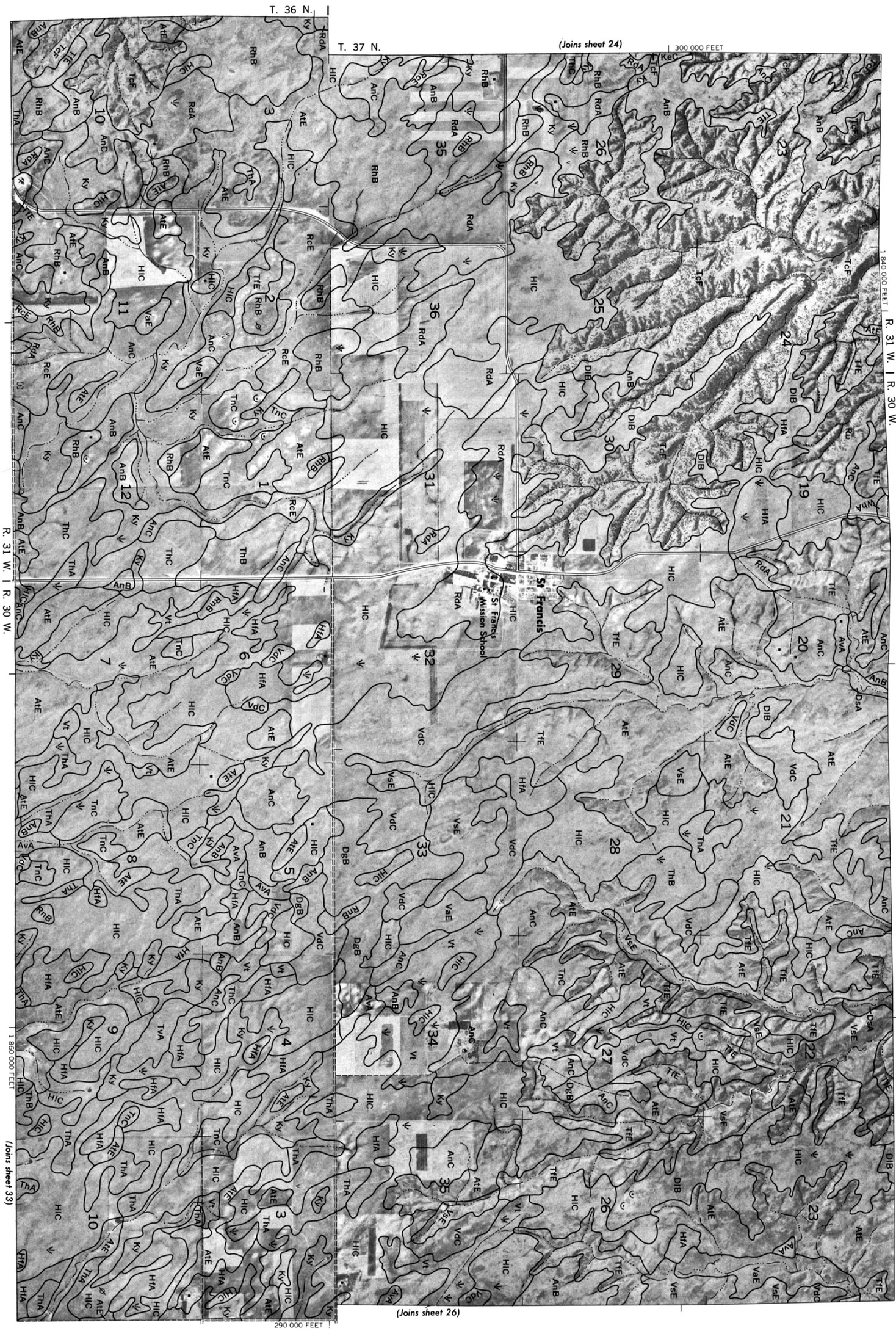
TODD COUNTY, SOUTH DAKOTA NO. 25

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 25

1 ¾ ½ ¼ 0 1 2 3 Miles

5000 4000 3000 2000 1000 0 5000 10000 15000 Feet

Scale 1:31680

N

25

The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 26

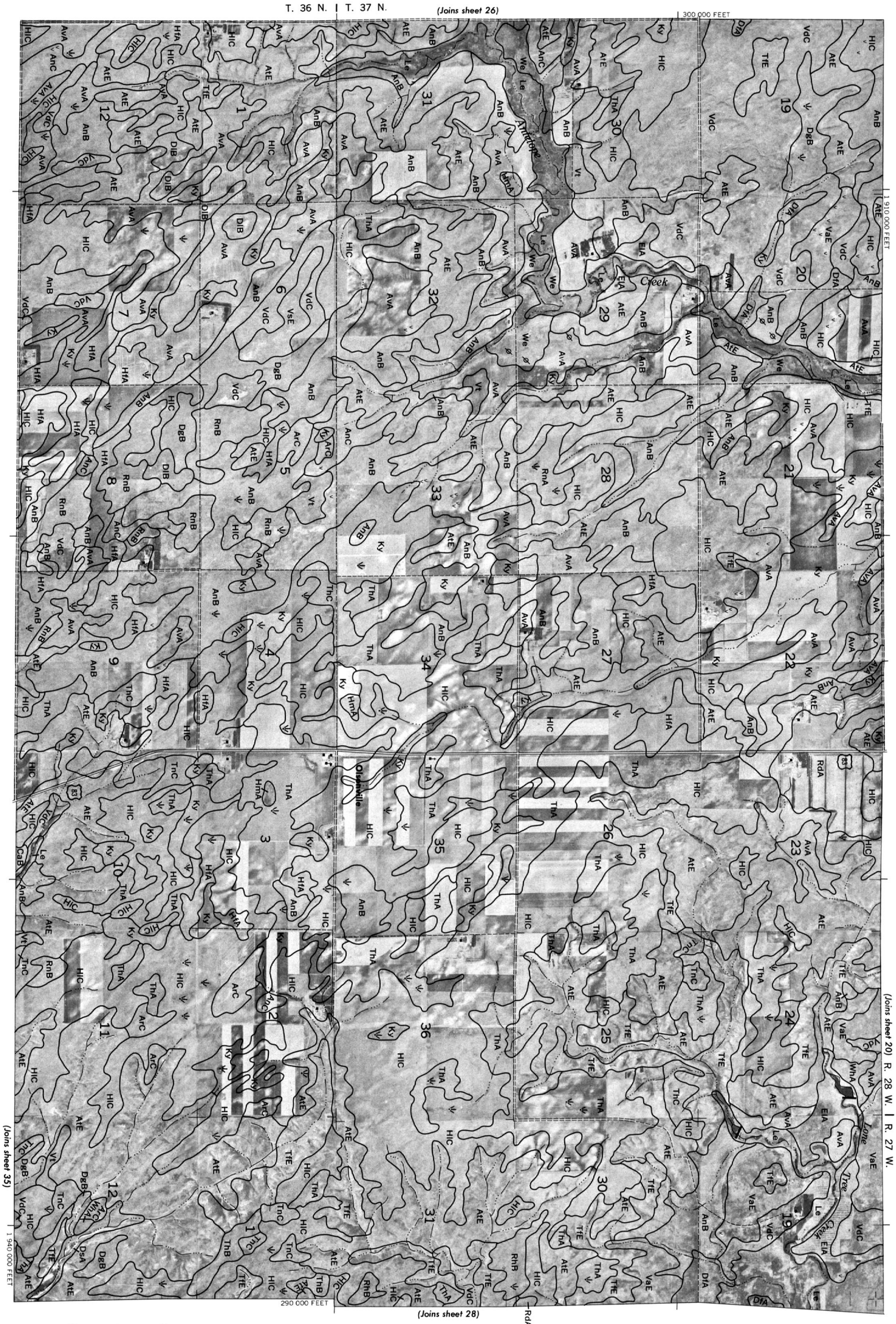
TODD COUNTY, SOUTH DAKOTA NO. 27

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 27

27

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 28

R. 27 W. | R. 26 W.

1 970 000 FEET

300 000 FEET

(Joins sheet 21)

(Joins sheet 29)

(Joins sheet 27)

(Joins sheet 36)

1 950 000 FEET

290 000 FEET

R. 27 W | R. 26 W.

T. 36 N. | T. 37 N.

28

N

3 Miles

2

15 000 Feet

10 000

5 000

Scale 1:31 680

1 0 1

½ 0 ½

¼ 0 ¼

5 000 4 000 3 000 2 000 1 000 0 5 000

The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station, United States Department of Agriculture, Soil Conservation Service.

TODD COUNTY, SOUTH DAKOTA NO. 28

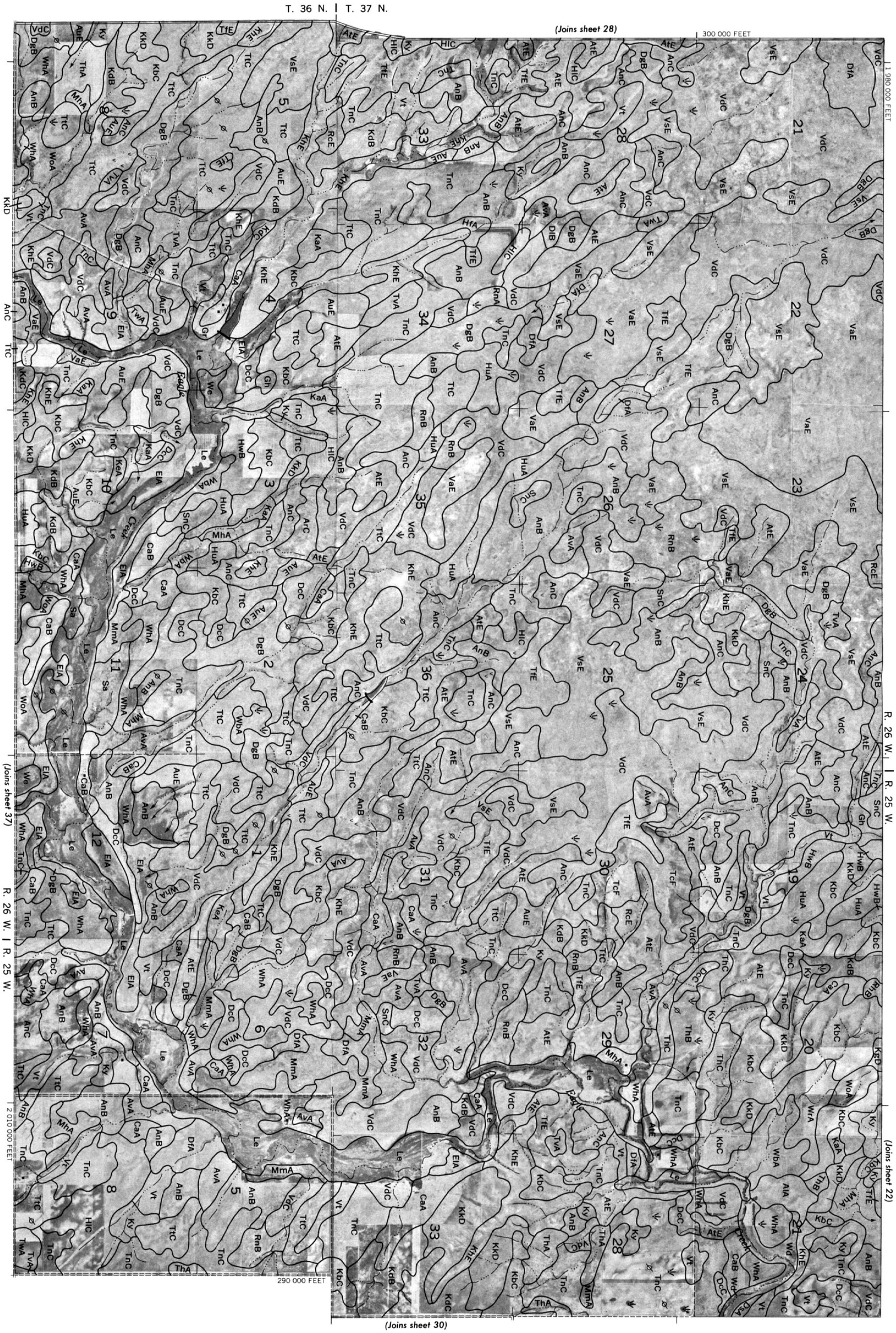
TODD COUNTY, SOUTH DAKOTA NO. 29

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 29

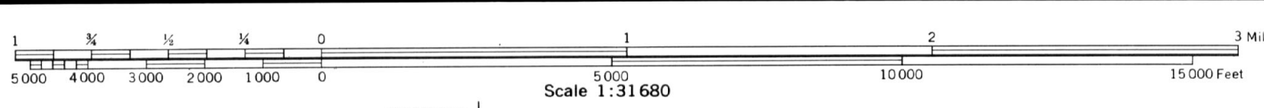
1 ¾ ½ ¼ 0 1 2 3 Miles

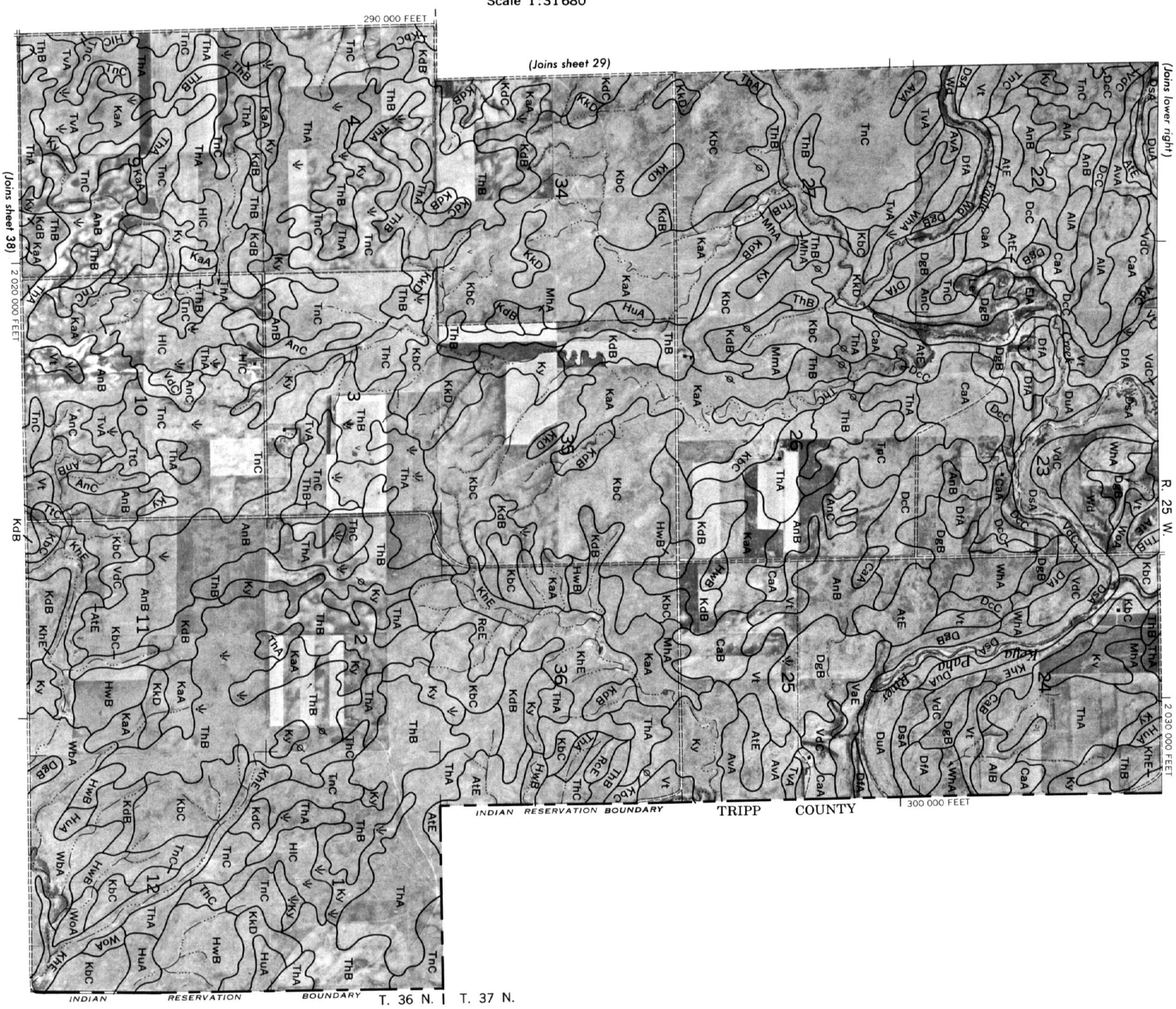
5000 4000 3000 2000 1000 0 5000 10000 15000 Feet

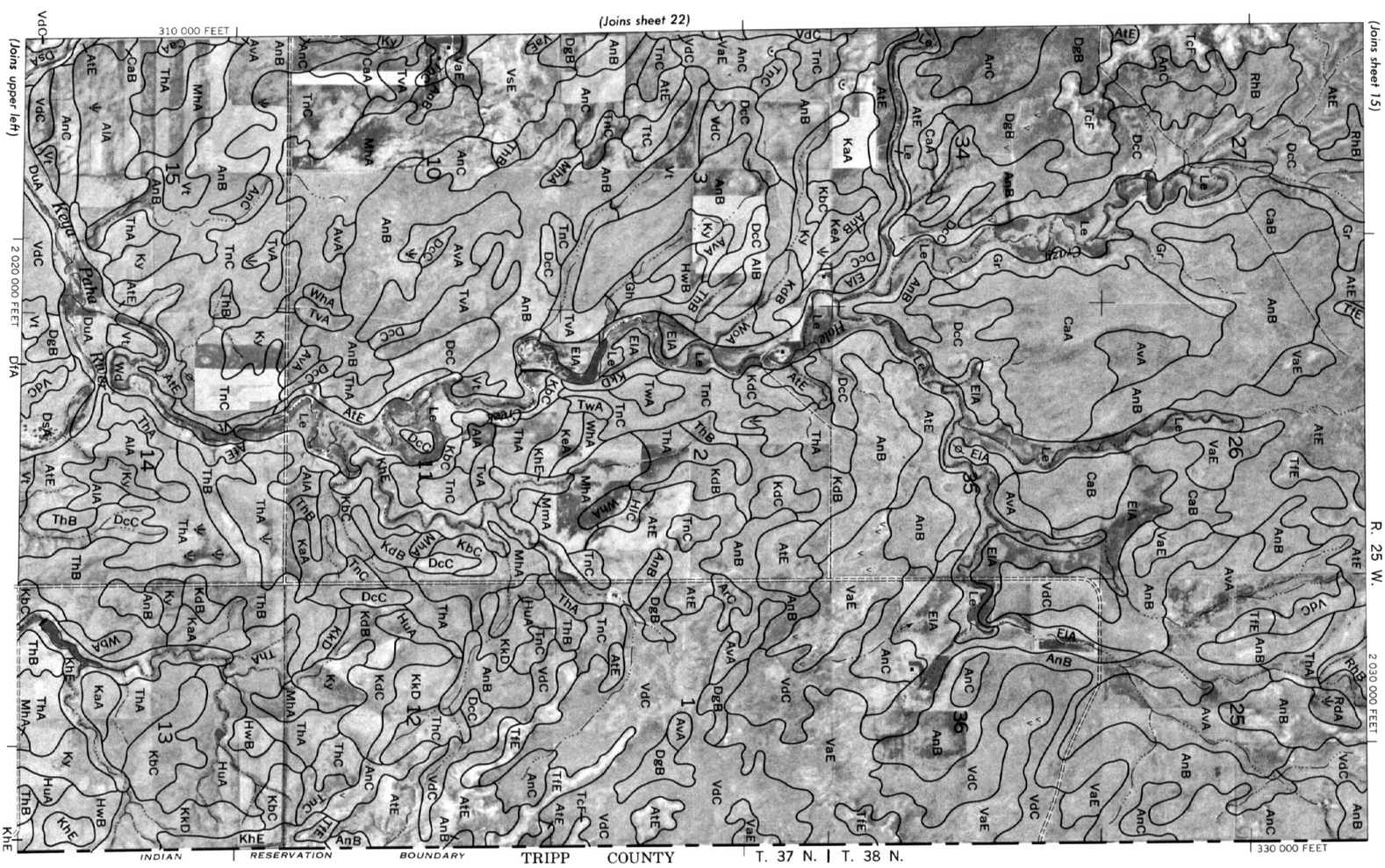
Scale 1:31680

N

29







The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 30

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 31

TODD COUNTY, SOUTH DAKOTA NO. 31

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 32

32

N

(Joins sheet 24)

R. 32 W.

R. 31 W.

1 830 000 FEET

280 000 FEET

WHITE RIVER

Spring Creek

(Joins sheet 31)

(Joins sheet 33)

260 000 FEET

(Joins inset, sheet 39)

1 800 000 FEET

T. 35 N. | T. 36 N.

3 Miles

15 000 Feet

10000

5000

Scale 1:31 680

5000 4000 3000 2000 1000 0 0

1 ¾ ½ ¼ 0

The area shown on this map sheet is part of the Rosebud Indian Reservation.

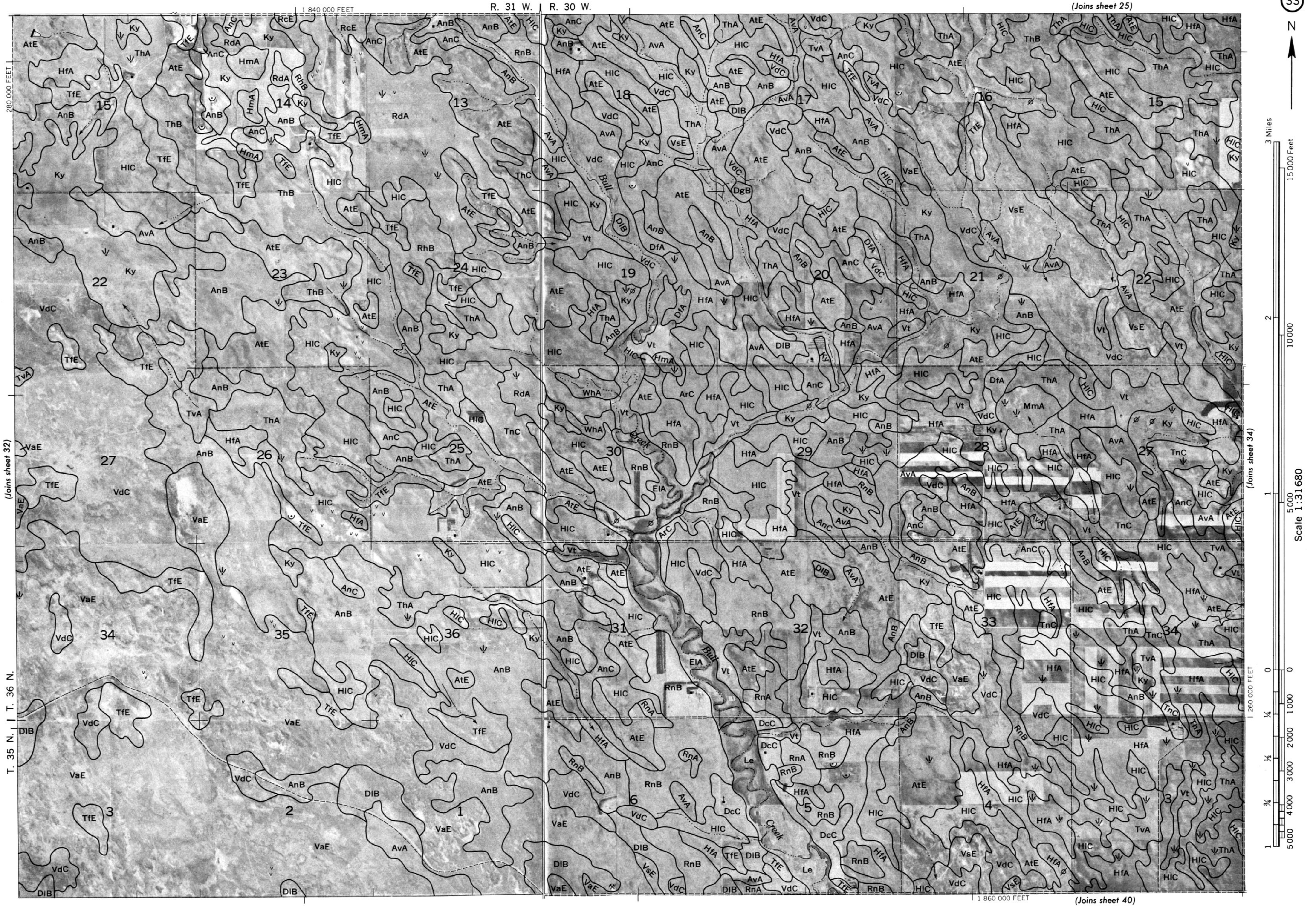
Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 32

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 33



TODD COUNTY, SOUTH DAKOTA NO. 33

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 34

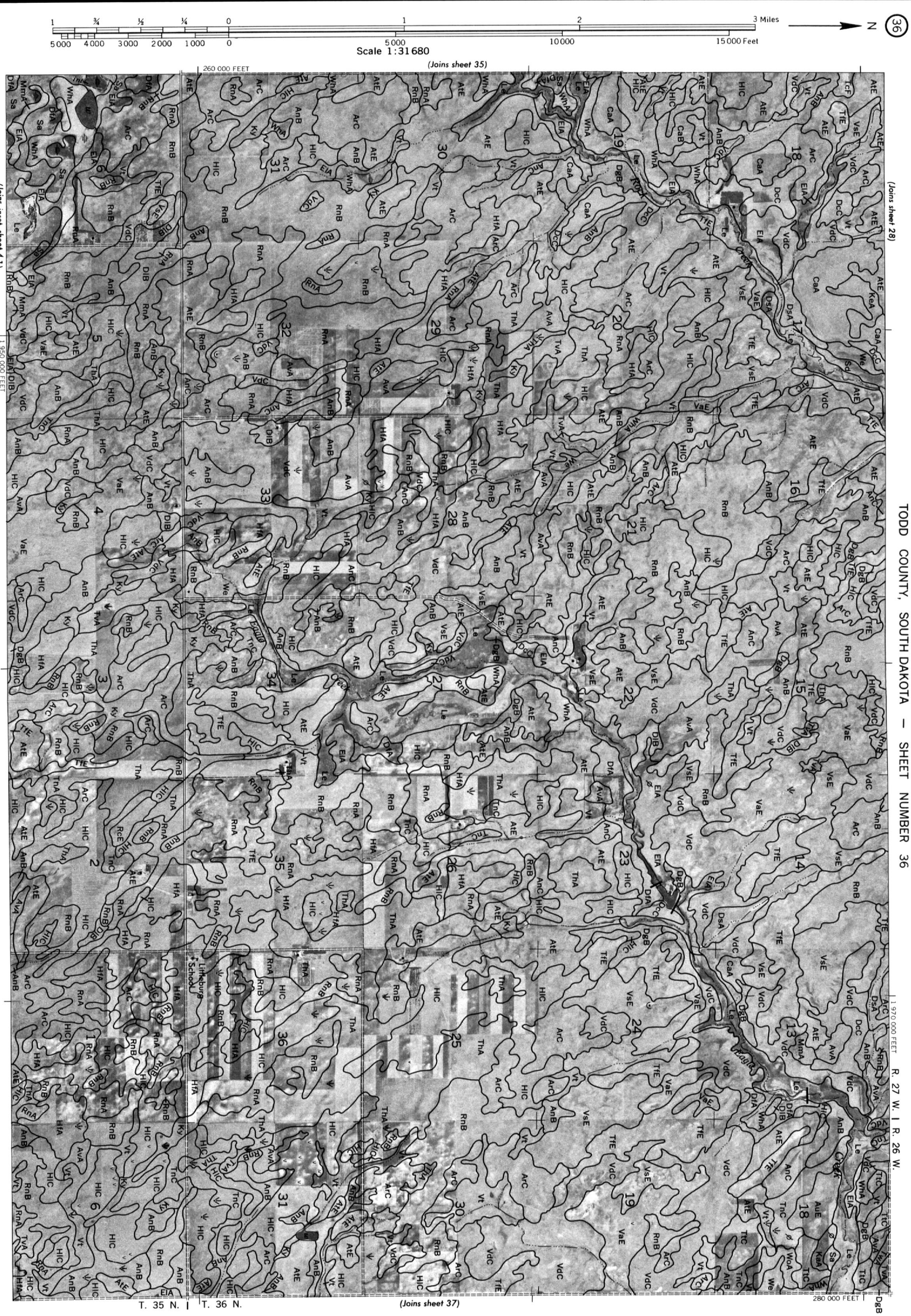
TODD COUNTY, SOUTH DAKOTA NO. 35

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000 foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, the United States Department of the Interior Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 36

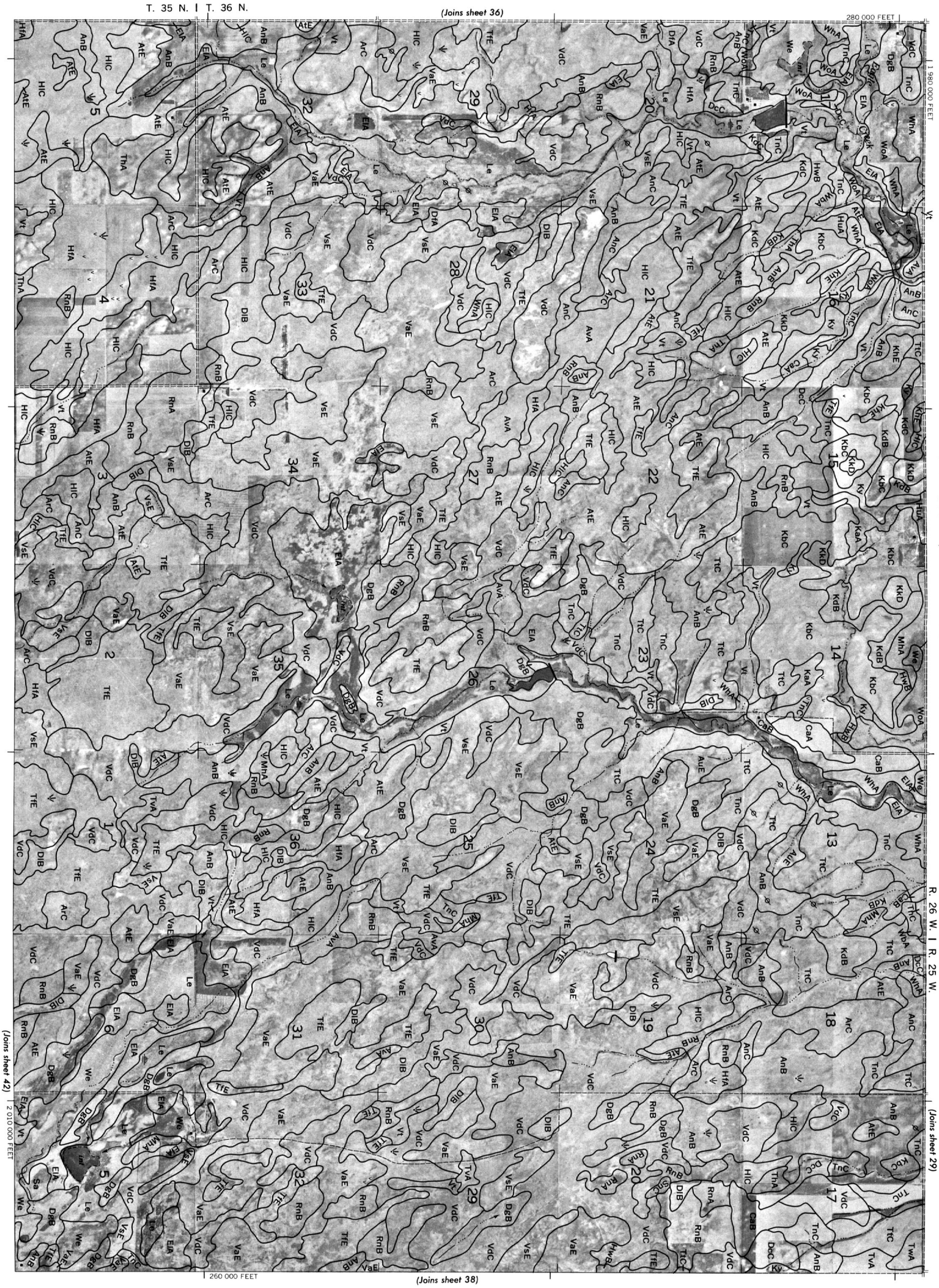
TODD COUNTY, SOUTH DAKOTA NO. 37

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.



TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 37

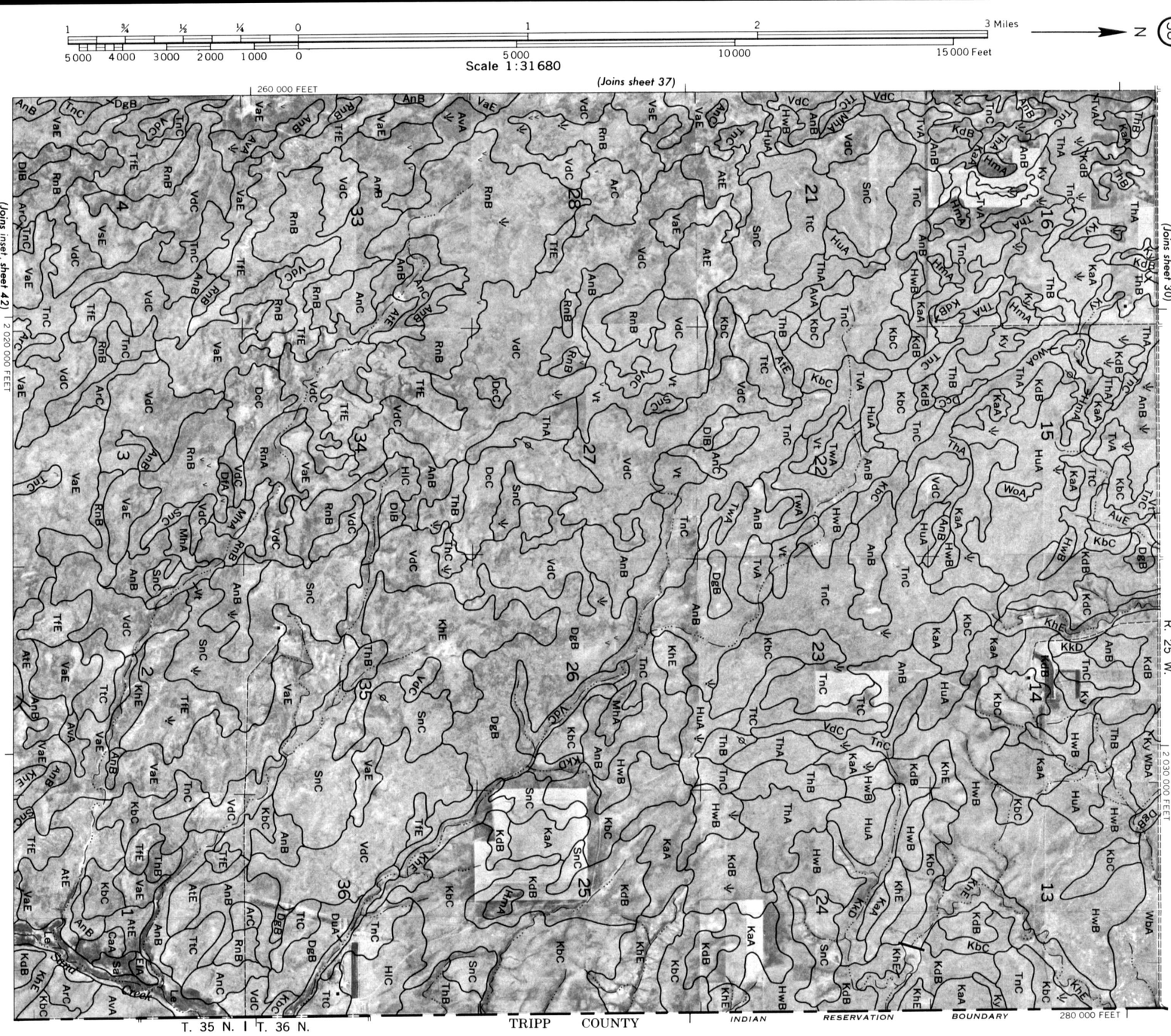
1 ¾ ½ ¼ 0 1 2 3 Miles

5000 4000 3000 2000 1000 0 5000 10000 15000 Feet

Scale 1:31 680

N

37



The area shown on this map sheet is part of the Rosebud Indian Reservation.

Land division corners are approximately positioned on this map.

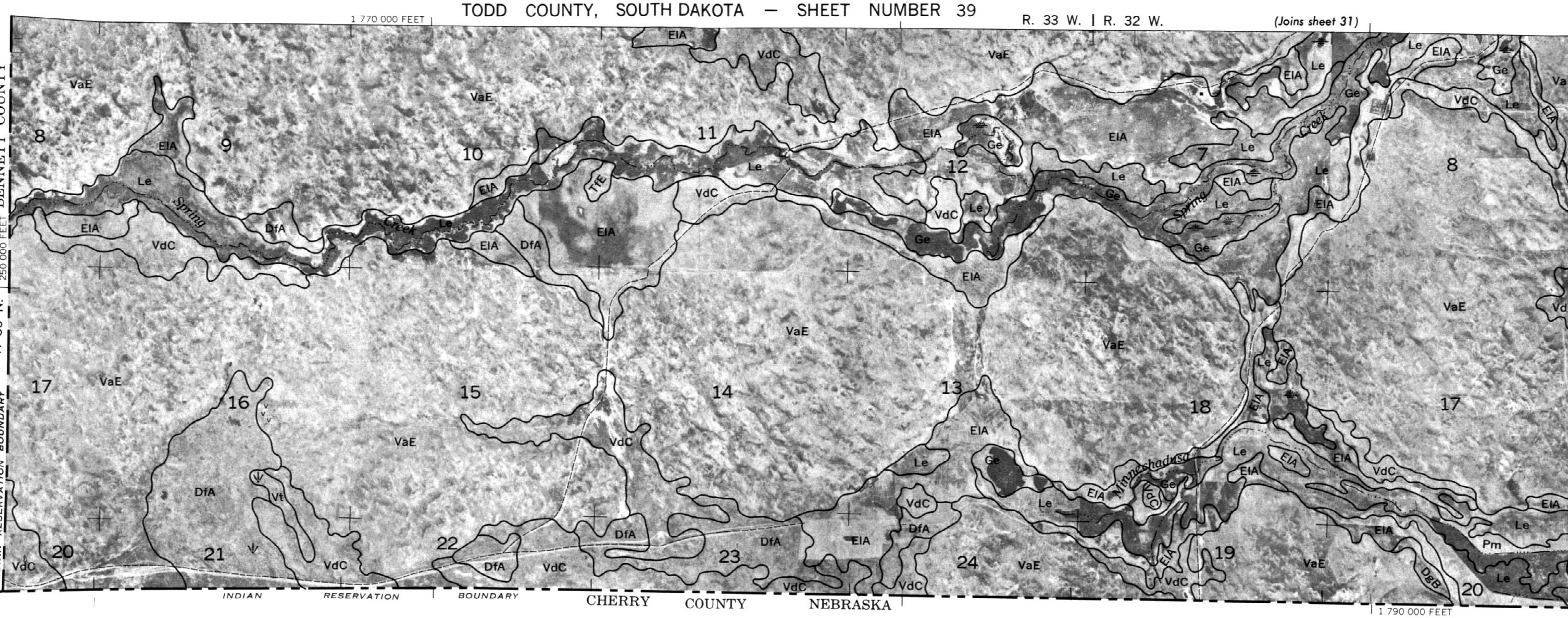
Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 38

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 39

39



TODD COUNTY, SOUTH DAKOTA NO. 39

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

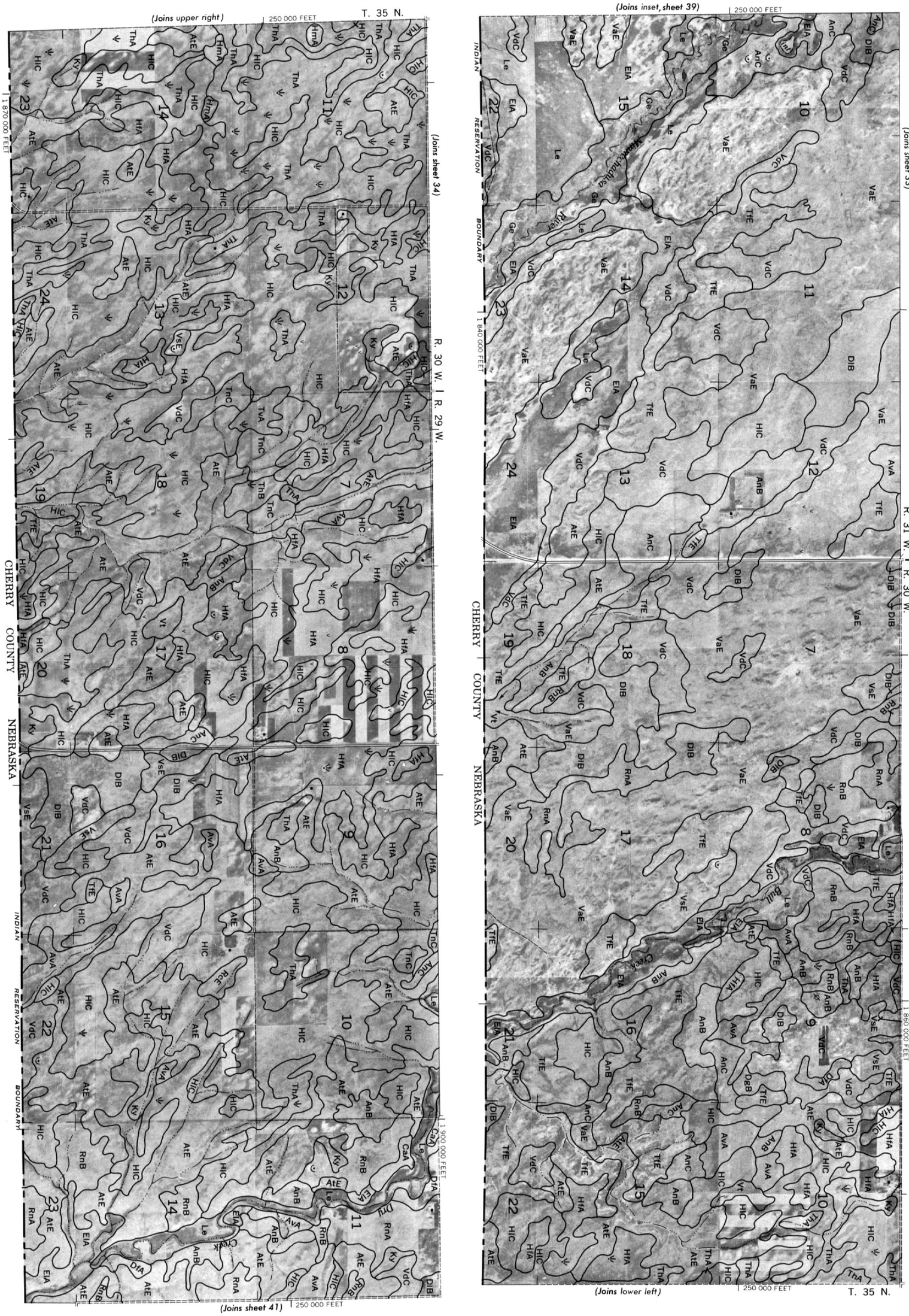
The area shown on this map sheet is part of the Rosebud Indian Reservation.

1 ¾ ½ ¼ 0 1 2 3 Miles — N

5000 4000 3000 2000 1000 0 5000 10000 15000 Feet

Scale 1:31680

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 40



The area shown on this map sheet is part of the Rosebud Indian Reservation.

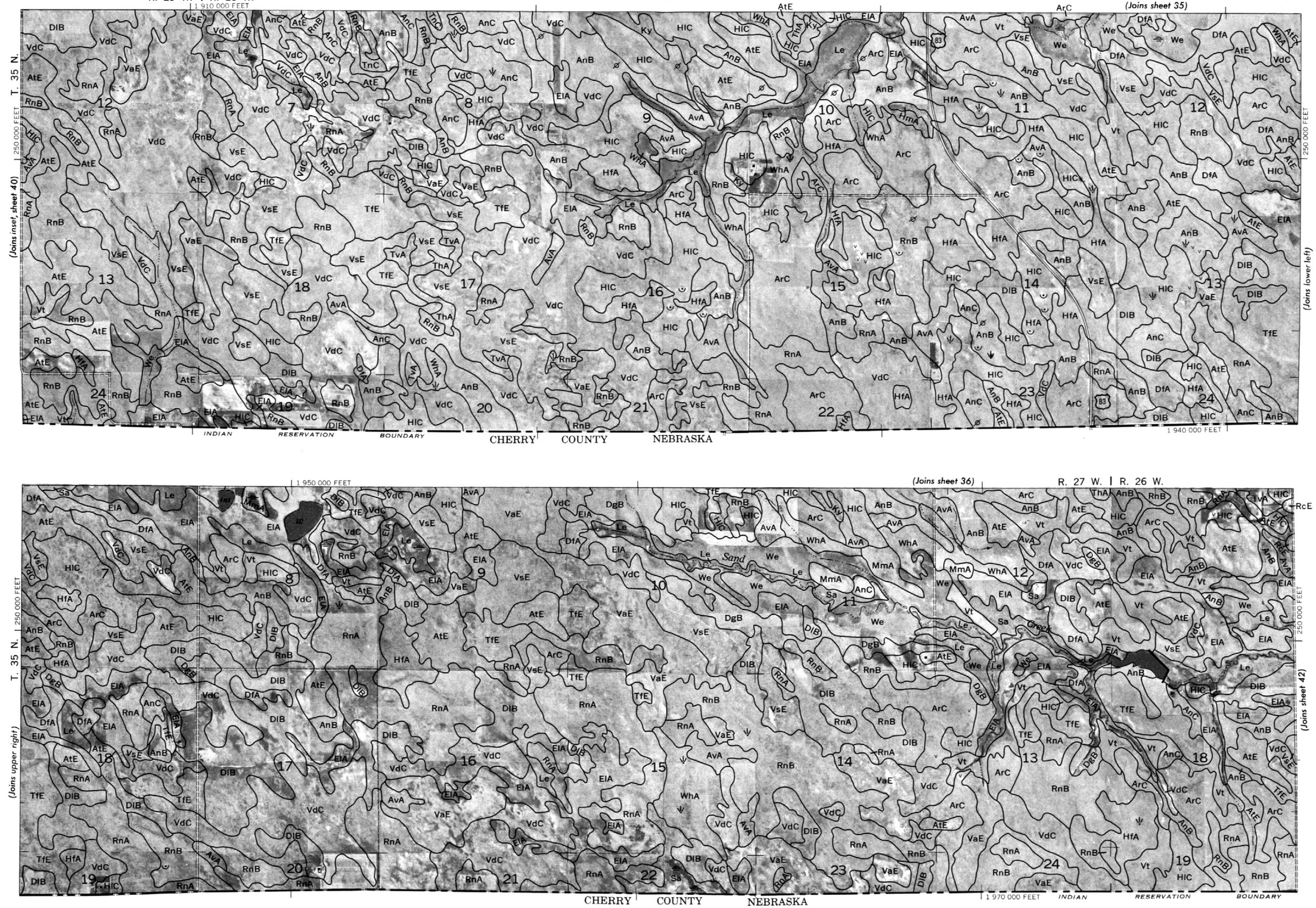
Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 40

TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 41



TODD COUNTY, SOUTH DAKOTA NO. 41

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

Land division corners are approximately positioned on this map.

The area shown on this map sheet is part of the Rosebud Indian Reservation.

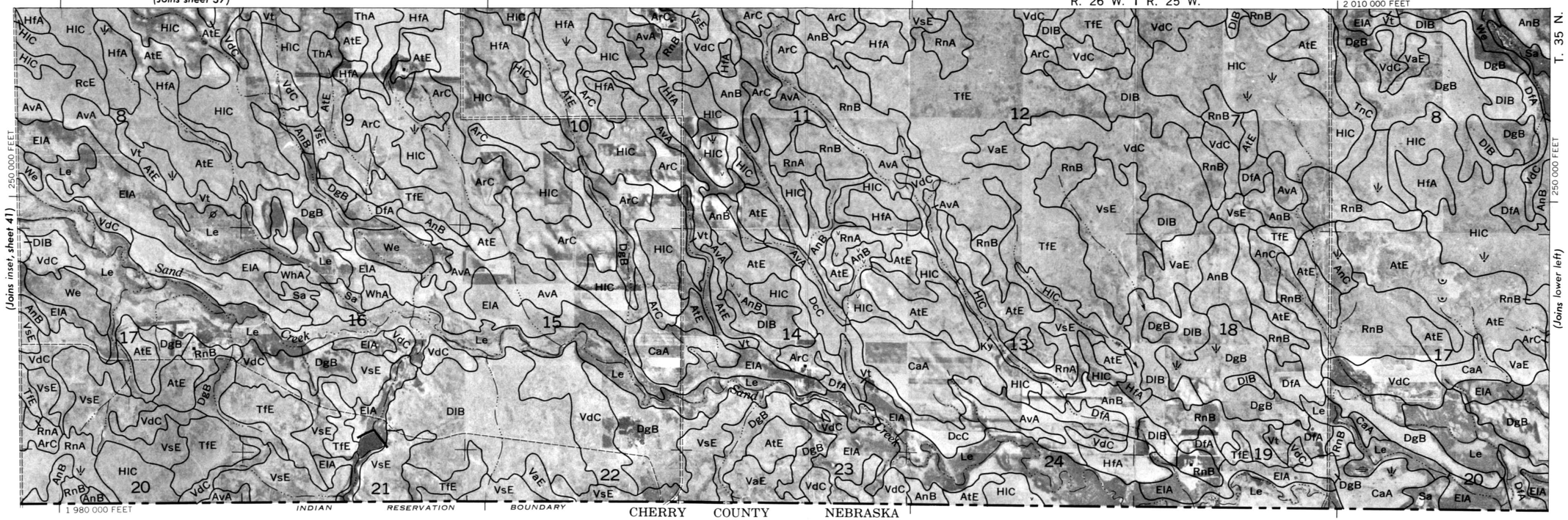
TODD COUNTY, SOUTH DAKOTA — SHEET NUMBER 42

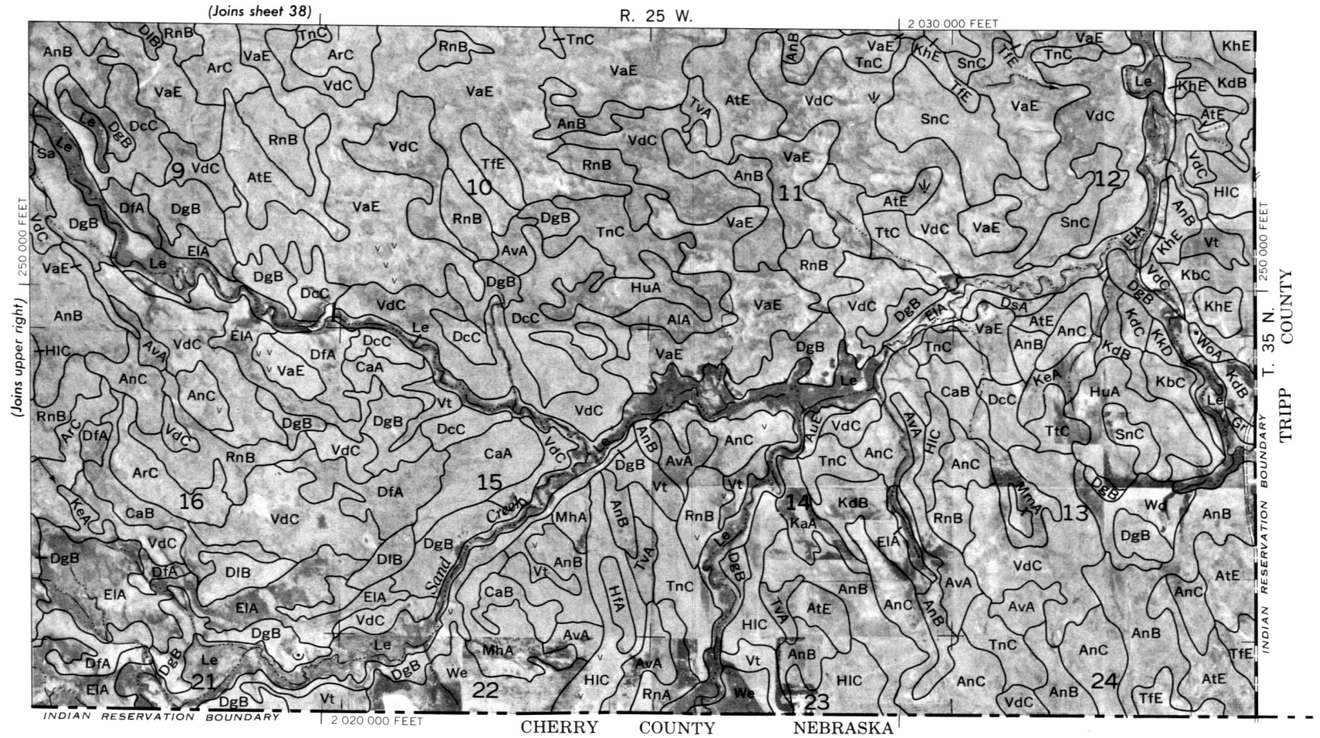
N

3 Miles 15 000 Feet 10000

Scale 1:31 680

5000 4000 3000 2000 1000 0





This map sheet is part of the Rosebud Indian Reservation.

The area shown on this map sheet is part of the Land division corners are approximately positioned on this map.

Photobase from 1963 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the South Dakota coordinate system, south zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, the United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station.

TODD COUNTY, SOUTH DAKOTA NO. 42